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TAMIL NADU GOVERNMENT GAZETTE

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Part II—Section 2

Notifications or Orders of interest to a section of the public issued by Secretariat Departments.

NOTIFICATIONS BY GOVERNMENT

HIGHER EDUCATION DEPARTMENT

Secretariat, 11th July 2013.

APPROVED SYLLABUS FOR TWENTY ONE SUBJECTS FOR DIRECT RECRUITMENT OF LECTURERS IN GOVERNMENT POLYTECHNIC COLLEGES AND SPECIAL INSTITUTIONS

[Technical Education - Tamil Nadu Educational Service Direct Recruitment of lectures in Government Polytechnic College and Special Institutions Syllabus for Twenty one Subjects Approved.]

No. II(2)/HE/480(c)/2013.

The following Government Order is Published:—

[G.O. Ms. No. 127, Higher Education (I-2), 11th July 2013, Aani 27, Vijaya, Thiruvalluvar Aandu-2044.]

READ:

From the Commissioner of Technical Education, Chennai-29, Lr.No. 31308/B2/2012, 21st June 2013.

Order :—No. 127, Higher Education (I 2), 11th July 2013.

The Government approve the Sullabi for twenty one subjects appended to this order, for the Direct Recruitment of Lecturers in Government Polytechnic Colleges and Special Institutions by Teachers Recruitment Board, Chennai.

(By Order of the Governor)

APURVA VARMA,
Principal Secretary to Government.

CIVIL ENGINEERING

Syllabus

Unit 1: Engineering Mathematics:

Linear Algebra – matrix algebra, linear equations, - eigen values and eigen vectors.

Calculus- Functions of single variable, limit, continuity and differentiability - mean value theorems, evaluation of definite and improper integrals - partial derivatives, total derivative - maxima and minima - gradient, divergence and curl - vector identities - directional derivatives - line, surface and volume integrals - stokes, gauss and green's theorems.

Differential equations – first order equations (linear, non linear) – higher order linear differential equations with constant coefficients - Cauchy's and Euler's equations – initial and boundary value problems – Laplase transformations and equations – solutions to one dimensional heat and wave equations.

Complex variables – analytic functions – Cauchy's integral theorem – Taylor and Laurent series – Fourier series – general, odd and even functions.

Probability and Statistics - .probability and sampling theorems- conditional probability – mean – median, mode and standard deviation – random variables – Poisson, Normal and Binomial distributions.

Numerical Methods – numerical solutions of linear and non-linear algebraic equations – integration by trapezoidal and simpson's rule, single and multi step methods for differential equations.

Unit 2: Mechanics:

Simple stress and strain relationships in one, two and three dimensions – principal stresses, stress transformation – mohr's circle – properties of surfaces – friction – principle of conservation of energy – impulse and momentum – relative motions - bending moment and shear force in statically determinate beams – simple bending theory – flexural and shear stresses – unsymmetrical bending – shear center – pressure vessels (thin and thick walled) – uniform torsion – springs – buckling of columns –combined and direct bending stresses – theories of failure – shear stress, strain energy and distortion energy theories – residual stresses.

Unit 3: Structural Analysis:

Analysis of statically determinate and indeterminate trusses – arches – cables and frames – deflections of statically determinate structures (beams, frames and trusses) – analysis of statically indeterminate structures (slope deflection, moment distribution methods) – matrix methods of structural analysis – influence lines for determinate and indeterminate structures.

Unit 4: Concrete Structures:

Concrete technology – properties of concrete – mix design – working stress and limit state design concepts – design of all structural components (slab, beam, column, foundation and stair case) – retaining walls – water tanks – basic elements of prestressed concrete – methods - analysis of beams at transfer and service loads – seismic load analysis – theory of vibration – seismology – response of structures – design methodology - all related IS codes.

Unit 5: Steel Structures:

Connections - analysis and design of tension, compression members, beams and beam columns – trusses - column bases – plate girders – plastic analysis – wind load analysis- all related IS codes.

Unit 6: Soil Mechanics:

Soil classification – engineering properties – three phase system – relationship and interrelationship – permeability – seepage – effective stress principle – consolidation – compaction – shear strength – CBR – Safe bearing capacity determination.

Unit 7: Foundation Engineering:

Sub surface investigation – sampling – standard penetration test – plate load test – earth pressure – effect of water table – layered soil – stability of slopes – foundation types and design requirements– stress distribution and settlement analysis – shallow and deep foundations.

Unit 8: Fluid Mechanics And Machines And Hydrology:

Properties of fluid – principle of conservation of mass – momentum – energy and corresponding equations – potential flow – Bernoulli's equation it and application – laminar and turbulent flow – flow in pipes – network – concept of boundary

layer – uniform and non uniform flow – specific energy concept – hydraulic jump – forces on immersed bodies – flow measurements in open. channels and pipes – dimensional analysis and hydraulic modeling – impact -kinematics of flow – velocity triangles – pumps and turbines.

Hydrologic cycle – rainfall – evaporation – infiltration – stage discharge relationships – unit hydrographs – flood estimation – reservoir capacity – reservoir and channel routing – well hydraulics.

Duty – delta – estimation of evapo–transpiration – crop water requirements – design of lined and unlined canals – waterways – head works – gravity dams and spill ways – design of permeable foundation – types of irrigation system – irrigation methods – water logging and drainage.

Unit 9: Water Supply And Waste Water Disposal

Quality standards – basic unit processes and operations - water treatment – drinking water standards – water requirements – surface water treatment – distribution – sewage and its treatment – quantity and characteristics of waste water – primary, secondary and tertiary treatment– effluent discharge standards – domestic waste water treatment – quantity and characteristics – treatment unit operations and unit processes – sludge disposal. – types of pollutants – their sources and impacts – standards and limits.

Unit 10: Highway Engineering

IRC standards – geometric design of highways – materials – construction and maintenance – testing and specifications of materials – design of flexible and rigid pavements – traffic characteristics – theory of traffic flow – intersection design – traffic signs and signal design – highway capacity – importance of surveying – principles and classification – mapping – coordinate system – map projections – measurements of distance and directions – leveling – theodolite traversing –errors and adjustments – curves.

MECHANICAL ENGINEERING

Syllabus

Unit 1: Engineering Mathematics:

Linear Algebra: Matrix algebra, Systems of linear equations, Eigen values and eigen vectors.

Calculus: Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

Probability and Statistics: Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

Unit 2: Applied Mechanics and Strength of Materials:

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses.

Unit 3: Theory of Machines and Design:

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

Vibrations: Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

Design of machine elements: Failure theories; principles of design of bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

Unit 4: Fluid Mechanics and Hydraulic Machinery:

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy; kinematics and dynamics of flow; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses. Hydraulic machines- Pelton-wheel, Francis and Kaplan turbines, velocity diagrams.

Unit 5: Heat Transfer:

Heat Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

Unit 6: Thermodynamics:

Thermodynamics: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion.

Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycles. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes.

Unit 7: Manufacturing Engineering:

Engineering Materials: Structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

Metal Casting: Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations.

Forming: Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy.

Joining: Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

Unit 8: Machining and Machine Tool Operations:

Machining and Machine Tool Operations: Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, principles of design of jigs and fixtures

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools.

Unit 9: Production Planning and Control:

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Inventory Control: Deterministic and probabilistic models; safety stock inventory control systems.

Unit 10: Operations Research:

Operations Research: Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

ELECTRICAL AND ELECTRONICS ENGINEERING

Syllabus

Unit- 1 Engineering Mathematics

Linear Algebra: Matrix Algebra, Systems of Linear equations, Eigen Values and eigen vector.

Calculus: Mean Value Theorems, Theorems of integral Calculus Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order equation (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, initial and boundary value problem, Partial Differential Equations and variable separable method.

Complex variables: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, Residue theorem, solution integrals.

Numerical Methods: solutions of non-linear algebraic equations, single and multistep methods for differential equations.

Transform Theory: Fourier transform, Laplace transform, Z-transform.

Unit -2 Electric Circuits and Fields:

KCL, KVL, node and mesh analysis, transient response of dc and ac network, sinusoidal steady –state analysis, resonance, ideal current and voltage sources, Thevenin's Norton's and Superposition and Maximum Power Transfer theorems, three phase circuits.

Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions, Ampere's and Biot-Savart's laws, inductance, dielectrics, capacitance.

Unit-3 Digital Signal Processing:

Representation of continuous and discrete-time signals, shifting and scaling operations, linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier, Laplace and Z transforms.

Unit – 4 Electrical Machines:

Single phase transformer – equivalent circuit, phase diagram, tests, regulation and efficiency, three phase transformers – connections, parallel operation, auto- transformer, energy conversion principles, DC machines- types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors, three phase induction motors- principles, types, performance characteristics, starting and speed control, single phase induction motors, synchronous machines- performance, regulation and parallel operation of generators, motor starting, characteristics and applications, Special Electrical machines.

Unit -5 Power Systems:

Basic power generation concepts, transmission line models and performance, cable performance insulation, corona and radio interference, distribution systems, per- unit quantities, bus impedance and admittance matrices, load flow, voltage control, power factor correction, economic operation, symmetrical components, fault analysis.

Unit – 6 Protection and Switchgear:

Principle of over – current, differential and distance protection, solid state relays and digital protection, circuit breakers, system stability concepts, swing curves and equal area criterion, High voltage generation and measurements.

Unit-7 Control System:

Principle and feedback, transfer function, block diagrams, steady- state errors, Routh and Nyquist techniques, Bode plots, root loci, lag, lead and lead-leg compensation.

Unit -8 Electrical and Electronics Measurements:

Bridges and potentiometers, PMMC, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, instruments transformers, phase, time and frequency measurement, Q- meters, Oscilloscopes, Transducers and Data acquisition systems.

Unit- 9 Analog and Digital Electronics:

Characteristics of diodes, BJT, FET, amplifiers- biasing,, equivalent circuit and frequency response, oscillators and feedback amplifiers, operational amplifiers- characteristics and applications, simple active filters, VCOs' and timers, combinational and sequential logic circuit, multiplexer, Schmitt trigger, multi vibrators, sample and hold circuit, A/D and D/A convertors, 8085 and 8086-microprocessor and 8051 microcontroller basics, architecture, programming and interfacing.

Unit – 10 Power Electronics and Drives:

Semiconductor power diodes, transistors, thyristors, TRIACs, MOSFETs and IGBTs- static characteristics and principles of operation, triggering circuits, phase control rectifiers, bridge converters- fully controlled and half controlled, principles of choppers and inverters, basic concepts of adjustable speed dc and ac drives.

ELECTRONICS AND COMMUNICATION ENGINEERING

Syllabus

Unit 1: Engineering Mathematics:

Linear Algebra: Matrix Algebra, Systems of linear equations, Eigen values and eigen vectors.

Calculus: Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and Minima, Multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order equation (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential Equations and variable separable method.

Complex variables: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent' series, Residue theorem, solution integrals.

Probability and Statistics: Sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlationand regression analysis.

Numerical Methods: Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

Unit 2: Networks:

Graphs Theory: Matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Network Analysis: Nodal and mesh analysis. Network theorems: Superposition, Thevenin's, Norton's, Maximum power transfer theorems, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions; State equations for networks.

Unit 3: Electromagnetics:

Elements of vector calculus; Electrostatic Fields: Coulomb's Law, divergence and curl, Gauss' and Stokes' theorems; Magnetic Fields: Biot-Savat's Law, Ampere's circuital Law, Faraday's Law, Maxwell's equations, Poynting vector; Waveguides: TE and TM modes in rectangular and circular waveguides; boundary conditions; Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Fundamentals and Parameters of VHF and UHF antennas and Wave Propagation; RF and Microwave circuits and systems.

Unit 4: Electronic Devices and Circuits

Energy bands, Carrier transport in silicon, Generation and recombination of carriers; P-N junction diode, Zener diode, Tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, PIN and avalanche photo diode, Lasers; device technology of integrated circuits. Small signal equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Biasing and bias stability of transistor and FET amplifiers. Rectifiers and Power Supplies; Feedback amplifiers and Oscillators, Tuned Amplifiers, Multivibrators; Operational Amplifiers and its applications; Function generators and wave-shaping circuits, 555 Timers.

Unit 5: Digital Circuits:

Boolean algebra, minimization of Boolean functions; logic gates. Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers; ADCs, DACs. Semiconductor memories; Microprocessors (8085 and 8086) and Microcontrollers (8051 and PIC): architecture, programming, and applications.

Unit 6: CMOS VLSI Systems:

MOSFET's as switches, Basic logic gates in CMOS, CMOS layers, CMOS inverter, Dynamic CMOS, Floor planning and Routing, Low power design, Reliability and testing of VLSI circuits, CMOS clocking and testing; Structural Gate Level Modeling; Switch Level Modeling; Behavioral and RTL Modeling – Multiplier, encoders, decoders, flip flops, registers; arithmetic circuits in CMOS VLSI.

Unit 7: Signal Processing:

Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems: Signal transmission through LTI systems. Infinite impulse response filters; Finite impulse response filters; Quantization effects and DSP architecture.

Unit 8: Control Systems:

Basic control system components; Open loop and closed loop systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative control.

Unit 9: Analog and Digital Communication Systems:

Random signals and noise theory: Amplitude, Angle and Pulse modulation and demodulation systems, superheterodyne receivers; signal-to-noise ratio; Pulse code modulation; differential pulse code modulation; digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), Error Control Coding. Satellite Communication; Fundamentals of information theory and channel capacity theorem.

Unit 10: Computer Communication:

Data Communication: OSI reference model; Modems; Error detection and Correction; Data link control and Protocols; Local Area Networks and Metropolitan Networks; Wide Area Networks; Cloud Computing: architecture, services. Mobile Communication: architecture, structure; OFDM principle; Basics of TDMA, FDMA; CDMA, GSM, GPRS and WiMax.

ELECTRONICS AND INSTRUMENTATION ENGINEERING AND INSTRUMENTATION AND CONTROL ENGINEERING

Syllabus

Unit 1: Engineering Mathematics:

Matrix - characteristic equation – eigen values and eigen vectors - Cayley-Hamilton theorem - partial derivatives – maxima and minima - linear differential equations with constant coefficients - linear first order simultaneous equations with constant coefficients - Taylor and Laurent expansions - residue theorem- Laplace transform - initial and final value theorems - inverse Laplace transform - Fourier series and Fourier transforms - solution of standard types of first order partial differential equations - z-transform - inverse z-transform - convolution theorem.

Unit 2: Circuit Theory:

Mesh current and node voltage methods of analysis - network reduction and network theorems - voltage and current division, source transformation - star delta conversion - Thevenin's and Norton's theorems - superposition theorem - maximum power transfer theorem - series and parallel resonance - frequency response - quality factor and bandwidth - self and mutual inductance - transient response for dc and sinusoidal inputs - analysis of three phase 3-wire and 4-wire circuits - power and power factor measurements in three phase circuits.

Unit 3: Analog and Digital Electronics:

Diode, BJT, JFET, MOSFET - characteristics and parameters – biasing - h parameters - amplifiers - frequency response - RC coupled amplifier - power amplifiers – feedback amplifiers - oscillators - wave shaping circuits - single and polyphase rectifiers - filters - design of Zener and transistor series voltage regulators - op-amp characteristics - frequency response - summer, integrator, instrumentation amplifier, first and second order active filters, V/I and I/V converters, comparators, waveform generators, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - dual slope, successive approximation and flash types - isolation amplifiers, opto-coupler.

Boolean algebra - De-Morgan's theorems - simplification using K-maps and Quine McCluskey method - logic gates - design of arithmetic circuits - encoders, decoders, multiplexers and demultiplexers - flip flops – counters - shift registers - design of synchronous and asynchronous sequential circuits. Design of sequential networks using PAL, PLA - FPGA - CPLD - 8085 and 8051 architectures - instruction sets - programming - interrupt structures - memory interfacing – interfacing of 8255 PPI, 8279 key board display controller, 8253 timer/ counter - interfacing with 8085 - A/D and D/A converter interfacing.

Unit 4: Electrical and Electronic Measurements:

Ballistic, D'Arsonval galvanometers - principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type and thermal type meter, rectifier type - theory, calibration - electrodynamometer type wattmeter - induction type kwh meter - induction type energy meter -dc potentiometer - ac potentiometer - C.T and P.T - Wheatstone bridge - Kelvin double bridge - high resistance measurement - earth resistance measurement – Megger.

Measurement of inductance, capacitance - Q of coil - Maxwell bridge - Wein's bridge - Schering bridge - Anderson bridge - Campbell bridge to measure mutual inductance - digital voltmeters and multimeters - microprocessor based DMM with auto ranging and self diagnostic features - digital IC tester - frequency, period, time interval and pulse width measurement - cathode ray oscilloscope - sampling and storage scopes - wave analyzers - seven segment and dot matrix display - digital recording and data loggers - modern instrumentation and control systems - OSI model - EIA 232 interface standard - EIA 485 interface standard - EIA 422 interface standard - 20 ma current loop - serial interface converters.

Unit 5: Control Systems:

Open and closed loop systems - transfer function - signal flow graphs - time domain response - I and II order system response - frequency response - Bode plot - polar plot - determination of closed loop response from open loop response - correlation between frequency domain and time domain specifications - characteristic equation - location of roots in s plane for stability - Routh Hurwitz criterion - root locus construction - effect of pole, zero addition - gain margin and phase margin - Nyquist stability criterion - lag, lead and lag-lead networks - compensator design using bode plots - state space analysis-controllability and observability - pole placement - state observer design - features of linear and non-linear systems - phase plane analysis of linear and non-linear systems - isocline method - describing function analysis of non-linear systems - conditions for stability - Liapunov's stability concept - Liapunov's direct method - Popov's criterion - time varying optimal control - LQR steady state optimal control - optimal estimation - multivariable control design.

Unit 6: Transducers and Smart Sensors:

Units and standards - calibration methods - static calibration - classification of errors - error analysis - statistical methods - odds and uncertainty - classification of transducers - selection of transducers - characteristics of transducers - mathematical model of transducers - zero, I and II order transducers - response to impulse, step, ramp and sinusoidal inputs - variable resistance transducers - variable inductance and variable capacitance transducers - induction potentiometer - variable reluctance transducers - principle of operation, construction details, characteristics and application of LVDT - capacitive transducer and types - capacitor microphone - frequency response - piezoelectric transducer, hall effect transducer - different types of photo detectors- digital transducers - smart sensors - fibre optic sensors, squid sensors, film sensors, MEMS - nano sensors.

Unit 7: Industrial and Analytical Instrumentation:

Pressure, flow, temperature and level measurements-principle of operation, installation and maintenance, calibration - measurement of force, torque, velocity, vibration, humidity, viscosity, and density - spectrophotometers (UV and IR) - pH meters - conductivity meters - analyzers (O_2 NO_2 , H_2S), chromatography (gas and liquid) - NMR spectroscopy, x-ray spectroscopy and mass spectrometer.

Unit 8: Digital Signal Processing:

Classification of signals: continuous and discrete, energy and power; mathematical representation of signals -

classification of systems: continuous, discrete, linear, causal, stable, dynamic, recursive, time variance - spectral density - aliasing effect - digital signal representation - DTLTI systems - difference equations – convolution - IIR design: analog filter design - Butterworth and Chebyshev approximations - digital design using impulse invariant and bilinear transformation - Discrete Fourier Transform - IDFT- computation of DFT using FFT algorithm - DIT and DIF using radix 2 FFT - FIR and IIR filter realization - parallel and cascade forms - FIR design: windowing techniques - linear phase characteristics.

Unit 9: Process Control:

Mathematical model of first order level, pressure and thermal processes - higher order process - interacting and non-interacting systems - continuous and batch processes - servo and regulator operations - characteristics of on-off, proportional, integral and derivative control modes - PI, PD and PID control modes - pneumatic and electronic controllers - optimum controller evaluation criteria - IAE, ISE, ITAE and % decay ratio - determination of optimum settings for mathematically

described processes using time response and frequency response - tuning -process reaction curve method - Ziegler Nichols method - damped oscillation method - feed-forward control - ratio control- cascade control - inferential control - split-range control -introduction to multivariable control - I/P converter - pneumatic and electric actuators - valve positioner - control valves - characteristics of control valves - inherent and installed characteristics - valve body - commercial valve bodies - control valve sizing - cavitation and flashing - selection criteria.

Unit 10: Logic and Distributed Control System:

Components of PLC - advantages over relay logic - architecture of PLC - programming devices - discrete and analog i/o modules - programming languages - ladder diagram - programming timers and counters - design of PLC - program control instructions, math instructions, sequencer instructions - use of PC as PLC - application of PLC - SCADA - data acquisition system -supervisory control - direct digital control - DCS - architectures - comparison - local control unit - process interfacing issues -communication facilities - operator interfaces - low level and high level operator interfaces - operator displays - engineering interfaces - low level and high level engineering interfaces.

COMPUTER ENGINEERING

Syllabus

Unit 1: Mathematics:

Mathematical Logic: Propositional Logic; First Order Logic. Probability*:* Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniform, normal, exponential, Poisson, Binomial. Set Theory & Algebra*:* Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra. Combinatorics*:* Permutations; Combinations; Counting; Summation; generating functions; recurrence relations; asymptotics. Linear Algebra: Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors. Numerical Methods*:* LU decomposition for systems of linear equations; numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-Raphson Methods; Numerical integration by trapezoidal and Simpson's rules. Calculus*:* Limit, Continuity & differentiability, Mean value Theorems, Theorems of integral calculus, evaluation of definite & improper integrals, Partial derivatives, Total derivatives, maxima and minima.

Unit 2: Digital Logic and Computer Architecture:

Digital Logic: Logic functions, Minimization, Design and synthesis of combinational and sequential circuits, Hardware Description Language for combinational and sequential circuits, Fixed and floating point number representation and computer arithmetic. Computer Organization and Architecture: Machine instructions and addressing modes, ALU and data-path, Single-Cycle Datapath and Control- Multi-cycle Datapath and Control-Micro-programming and Hard-wired Control Units- Behavioral HDL Description of Systems- Exceptions Handling. Pipelining: Pipelined MIPS Data path- Pipeline Hazards: Structural, Control, Data-Hazard Detection and Resolution- Pipelining control- Exceptions Handling. Memory System and I/O interfacing: Overview of SRAM and DRAM Design- Memory Hierarchy;-Cache memory design - Virtual memory- Performance issues -I/O device characteristics - Buses and bus arbitration -Processor/OS interface -DMA

Unit 3: Data Structures and Algorithms:

Data Structures: Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Graph theory: Graph Traversal – Topological Sorting – Dijkstra's Algorithm – Minimal Spanning Tree – Applications – DFS – Biconnectivity – Euler Circuits – Graph Coloring Problem. Search Structures and Priority Queues: AVL Trees – Red-Black Trees – Splay Trees – Binary Heap – Leftist Heap. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort – Sorting with disks – k-way merging. Algorithms: Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer, Backtracking and Branch and Bound; Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Concepts of complexity classes – P, NP, NP-hard, NP-complete.

Unit 4: System Programming and Operating Systems:

System Programming:: Elements of Assembly Language Programming, Pass structure of assemblers, design of single and two pass assemblers, Macros and Macro processors, Design of a macro pre-processor, Linkers: Concepts, Design of a linker, Loaders, software Tools: software tools for program development, editors, debug monitors, programming environments. Operating System**:** Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, Free-space management – Disk scheduling – Disk management – Swap-space management, I/O systems, Protection and security. Design principles of Linux and Windows 7.

Unit 5: Database Systems:

ER-model, Relational model: relational algebra, tuple calculus, SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependences and Normalization for Relational Databases. Data Storage and Query Processing: Record storage and Primary file organization- Operations on Files- Heap File- Sorted Files-Hashing Techniques – Index Structure for files –B-Tree - B+Tree – Query Processing. Transaction Processing: Concurrency control- Schedule and Recoverability- Serializability and Schedules – Two Phases locking- Deadlock- Recovery Techniques – Immediate Update- Deferred Update - Shadow Paging. Design of Object oriented Data Bses.

Unit 6: Theory of Computation and Compiler Design:

Regular Languages and Regular Expressions - Nondeterministic Finite Automata - Kleene's Theorem. Minimal Finite Automata-Pumping Lemma for Regular Languages- Context Free Grammars and Languages. Push Down Automata. Turing Machine, Recursively enumerable Languages, Non-recursive Language, Unsolvable problems. Compiler Design: Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.

Unit 7: Computer Networks:

ISO/OSI stack, LAN technologies : Ethernet, Token ring; Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IPv4, Application layer protocols: icmp, dns, smtp, pop, ftp, http; Basic concepts of hubs, switches, gateways, and routers. High Performance Networks: ISDN and BISDN, ATM and Frame relay, MPLS, Integrated and Differentiated Services, Optical Networks and Switching. Wireless Adhoc Networks: Operation models, Routing methods: Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols – Uni Cast routing protocol (AODV,DSR, DSDV) – Multi-Cast routing protocol (ODMRP) – Multi clustering– Power Issues. Network security – basic concepts of public key and private key cryptography, digital signature, firewalls.

Unit 8: Computer Graphics and Multimedia:

Line - Curve and Ellipse Drawing Algorithms –Two-Dimensional Geometric Transformations – Two-Dimensional Clipping And Viewing. - Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three- Dimensional Viewing – Color Models – Animation. Multimedia Systems: Multimedia Elements, Applications and Architecture – Evolving Technologies for Multimedia – Defining Objects for Multimedia Systems – Multimedia Data Interface Standards –- Multimedia Databases. Compression and Decompression: Types of Compression – Binary

Image Compression Schemes – Color, Gray Scale and Still – Video Image Compression - Audio Compression – Fractal Compression. Virtual Reality Design - Multimedia Database

Unit 9: Software Engineering:

S/W Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - Project Management Concepts -Software Project Planning Risk analysis and management-project scheduling and tracking software quality assurance-Software configuration management, Requirement analysis - software prototyping – prototyping in the software process – rapid prototyping techniques, Design process and concepts - Real time systems - Real time software design- Software testing –Types of software testing – strategic approach and issues – Software Metrics.

Unit 10: Web Technologies:

Basic Web Concepts – World Wide Web- Web Servers –Web Browsers – URL-MIME – HTTP–SGML- Internet Protocols and Standards. HTML Forms – CGI Concepts –Server – Browser Communication – E-Mail Generation– Applets - Java Script Programming-Dynamic HTML- ActiveX Controls-Multimedia-Client Side Script.- Server Side Scripting - Servlets- Java Server Pages - Session Management - Cookies -Database Access Through Web -SQL - Architecture for Database- System. E-Commerce –Business Models for E-Commerce-Enabling Technologies of the World Wide Web- E-Marketing-E-Security-E-Payment Systems-E-Customer Relationship Management.

PLASTIC TECHNOLOGY

Syllabus

Unit 1: Polymer Chemistry and Physics:

Functionality of monomers – classification of polymers – structure and conformations – General characteristics of chain growth polymerisation – alkene polymerisation by free radical, anionic and cationic initiators, their mechanism and kinetics – General characteristics of step growth polymerization – Mechanism and kinetics of co-polymerisation – Types of copolymers – Polymerisation Techniques – Bulk, Solution, Suspension, Emulsion and Interfacial Polymerisation.

Glass transition temperature – Multiple transition – Tg measurement – Significance – Crystallinity in polymers – crystal morphologies – extended chain crystals, chain folding, lamellae, spherulites effect of crystallization – crystal nucleation and growth – Relationship between Tg and Tm – Concepts of unit cell, crystallite size and long period crystallisation and its kinetics – Avrami equation – determination of melting point and effects of various parameters on melting – Polymer solution thermodynamics.

Unit 2: Plastics Materials:

Plastics of commercial importance – Manufacture, properties and applications of major Commodity Plastics: Polyethylene, Polypropylene, Polyvinyl chloride, poly styrene and other styrenics, PMMA, PAN.

Engineering Plastics: Polyamides, Polyacetal, PET, PBT and PC.

Thermosetting polymers: Urea-formaldehyde, Phenol-formaldehyde and Melamine-formaldehyde, unsaturated polyester and epoxy resins.

High Performance Plastics: Polyurethane, Fluorine containing plastics, polyphenylene oxide, polyphenylene sulfide, Polysulphones, PEEK, Polyimides, Polybenzimidazoles, aromatic polyamides and Liquid crystalline polymers.

Unit 3: Plastics Compounding and Processing:

Classification of plastics processing operations – primary and secondary processing – Difference in approach to processing of thermoplastics and thermosets – Extrusion, Injection Moulding, Blow moulding, Thermoforming, Rotational moulding, Film blowing, Fibre spinning, Calendaring, Compression and Transfer moulding, Reaction Injection Moulding. Compounding ingredients : fillers, plasticisers, colourants, stabilizers, flame retardants, antioxidants, Lubricants and processing aids – compounding equipments: Twin screw extruder, Banbury and other mixing equipments.

Unit 4: Plastics Testing and Characterisation:

Importance of testing: Specifications – Standards – Various testing methods and organisations such as ASTM, BIS, ISO and DIN, etc – Test specimen preparation – conditioning procedure – Identification of plastics – Analytical tests; Mechanical properties: Short term and long term mechanical properties, mechanical properties of surfaces – Thermal properties – Electrical properties – Optical properties – Flow properties – Experimental set up, determination, significance and factors affecting all the above tests – Correlation of tests with actual performance – Plastics End products testing – Statistical quality control in various tests.

Molecular weight determinations by end group analysis, osmometry, light scattering, viscometry and GPC – Thermal properties by DSC, DTA and TGA – Crystallinity by density measurements.

Unit 5: Plastics Product and Mould Design:

Fundamentals of plastics product design – Design criteria based upon product functions and geometry – Stress analysis – Material selection – Forming process selection – Moulding consideration: Draft, radii, dimensional tolerances, wall thickness, ribs and bosses, inserts, sink marks, under cuts, feeding system, gate location, flow pattern, shrinkage and post moulding shrinkage.

Injection mould design: single, multicavity, semi automatic and automatic moulds – Design details for compression moulds, transfer moulds and blow moulds, die design – Types of extrusion dies and their design difference – Material selection for mould making – mould and die making processes – Applications of CAD in Design – Operating systems – Wire frame, surface and solid modeling – Elementary idea about Unigraphics, Ideas, Pro-E and Mold flow software.

Unit 6: Recycling of plastics and Waste Management:

Sorting and separation techniques of mixed plastics – Wet and Dry separation – Centrifugal sorting - Electrostatic sorting – X ray based sorting – Size reduction – Densification process – Recycling of PET, HDPE, LLDPE films and PVC etc. –

Pyrolysis and incineration of plastic waste for energy recovery – polymer degradation – types of degradation – thermal, photo and oxidative degradation – Plastics and environment – global policy – regulations – Bio-degradable polymers – prospects and utilizations – Applications of Bio-degradable plastics.

Unit 7: Polymer Rheology and Basic Chemical Engineering:

Introduction to Rheology – Newtonian and Non-Newtonian fluids – pseudoplastic, Bingham, dilatant and thixotropic behaviors – Factors influencing flow behavior – Mechanical models – Relationships of various approaches taken in describing the viscous and elastic properties – measurement of Rheological properties – Application of Rheological studies in polymer processing.

Basic concepts of measurements: Temperature, pressure, Flow, Level and Force - Control system – Controllers – Computer controllers.

Unit 8: Polymer composites and other applications:

Polymer composites – Advantages and disadvantages of composites –Composite reinforcing fibers: Natural fibers (Cellulose, jute and coir), boron, carbon, ceramic, glass and aramide fibres – Surface treatment of fibers – Effect of fibrous reinforcement on composite strength – thermoplastic and thermosetting matrix resins – Nano composites – short and continuous fiber reinforcement composites – critical fibre length – anisotropic behavior – Fabrication techniques: Pultrusion, filament winding, prepreg technology, injection and compression moulding, RTM, hand lay up and spray up – Properties and performance of composites.

Plastics foams – Types of foams – foaming ingredients – Polyurethane foams – EPS foams – Plastics Packaging – Advantages and disadvantages – Printing on Plastics Packages.

Unit 9: Allied Materials and its technology:

Rubbers materials – Chemical structure and its effect on rubber properties – General purpose rubbers: NR, BR, SBR, IR – Special purpose rubbers: IIR, EPRs, NBR, CR, ACM, EMA, EVA – High performance rubbers: Silicones, Fluorine containing rubbers, PUs – Thermoplastic rubbers – various types.

Rubber Compounding and machinery: vulcanization systems – carbon black and non-black fillers – other additives – two roll mill – Internal mixers – extruders – curing machinery.

Fibers: Essential characteristics and molecular architecture of fiber forming polymers – natural and man made fibers – spinning – General principles of finishing and dying of fibers. Adhesives and surface coatings: Natural, synthetic, reactive and non reactive adhesives – Applications – Surface preparation – Joint Design, Joint types, mechanism and theories of adhesion. Components of paints and coatings – mechanism of film forming and drying of coatings – powder coatings – water based coatings.

Unit 10: Polymer Blends and Alloys:

Definition of polymer blends and Alloys – General behaviour of polymer mixture- Thermodynamics of polymer blends – Miscibility of Polymers – methods of determining miscibility – Immiscible blends and compatiblisation – Compatiblising agents – morphology and dispersion of immiscible blends – phase separation – Melt rheology of multiphase blends – IPN – Reaction blending and processing of specific polymer blends, their properties and applications.

CHEMICAL ENGINEERING

Syllabus

Unit 1: Organic Chemistry and Material Technology:

Carbohydrates – oils, fats and waxes – heterocyclic compounds-proteins-dyes and dying- pharmaceutical chemistry. - Ferrous and non ferrous metals – polymers, composites, ceramics and inorganic materials – single crystals – memory metals – intelligent materials.

Unit 2: Physical Chemistry:

Ionic equilibria – Degree of hydrolysis – Determination – acid-base indicators-their applications-solubility product principle – ionic equilibria involving complex ions – colloids – properties of colloids – coagulation of solutions – origin of charge on colloidal particles – determination of size of colloidal particles – Donnan Membrane equilibrium – emulsions-gels – application of colloids – Nuclear chemistry – applications of Radioactivity – Nuclear forces – pacing fraction- Binding energy – Nuclear fission – Nuclear reactors – Nuclear fusion – Hydrogen bomb – Nuclear reactions – cyclotron – Induced radio activity.

Unit 3: Chemical Engineering Fluid Mechanics:

Fluid Properties, Hydrostatics, Eulerian and Lagrangian description of fluid motion, concept of local and convective accelerations, Euler equation, Bernoulli's equation, Concept of fluid rotation, vorticity, stream function and potential function, potential flow, Dimensional analysis, Fully-developed pipe flow, laminar and turbulent flows, friction factor, Darcy-Weisbach relation, flow measurement, qualitative ideas of boundary layer and separation, streamlined and bluff bodies, drag and lift forces.

Unit 4: Chemical Process Calculations:

Composition of Mixtures and solutions – gas calculations – material balance - Material balance with chemical reactions- Limiting and excess reactants – degree of completion – Application of material balance to various types of chemical reactions – recycle and bypassing operations – concepts of purge – humidity – and saturation – fuels and combustion, Hess law , calculation of standard heat of reaction, Heat of reaction at other temperatures – Effect of pressure and temperature on heat reaction – heats of solution and mixing.

Unit 5: Heat Transfer:

Basic modes of heat transfer, One dimensional steady state heat conduction, unsteady state, heat conduction, Lumped System Analysis, Use of Transient – Temperature charts, Free convection in atmosphere free convection on a vertical flat plate, Empirical relation, Forced convection – Laminar and turbulent convective heat transfer analysis, Introduction to Physical mechanism – Radiation properties – Radiation shape factors – Heat exchange between non black bodies – Radiation shields. Heat exchanger Classification – Temperature Distribution, LMTD Method and E-NTU Method, Heat transfer problems in aerospace engineering High-Speed flow Heat Transfer, gas turbine combustion chambers, Rocket thrust chambers, Aerodynamic heating –Ablative heat transfer.

Unit 6: Mechanical Operations:

Introduction to unit operations and their role in Chemical Engineering industries, Mechanical Operations types, Principles of size reduction, Laws and classification of crushing, pulverization and ultrafine grinding, working principle of equipments, Jaw crushers, gyratory crushers, hammer mill, crushing rolls, ball mills, and fluid energy mills, size enlargement techniques, classification & selection of conveyors, Storage of solids, Weighing of bulk solids, Classification of separation methods for different types of mixtures like solid-solid, solid-gas, solid-liquid, Phase separation, Gas-solid separation.

Unit 7: Mass Transfer Operation:

Distillation, steam distillation, enthalpy-concentration diagrams, flash vaporization and differential distillation for binary and multi component mixtures, Continuous rectification-binary systems, multistage tray towers, Mc Cabe and Thiele, continuous-contact equipment(packed towers), Ponchon and Savarit method, the enriching and stripping sections, Azeotropic and extractive distillation and its comparison, Liquid-Liquid operations, liquid-liquid equilibrium, equilateral triangular co-ordinates, stage wise contact, multistage cross-current extraction, Multi stage counter current without reflux

Unit 8: Chemical Engineering Thermodynamics-I:

The scope of thermodynamics, The first law and other basic concepts- equilibrium, the phase rule, constant-V and constant- P processes, Volumetric properties of pure fluids, Cubic equations of state, generalized correlations for gases, generalized correlations for liquids, molecular theory of fluids, Thermodynamics of flow processes, calculation of ideal work and lost work, The second law of thermodynamics- mathematical statement, the third law of thermodynamics, Refrigeration and liquefaction, Thermodynamic properties of fluids.

Unit 9: Petrochemical Technology:

Introduction, Development of Petrochemicals Industry in India, Economics, general cost considerations, Sources of petrochemicals - Natural gas and petroleum, classification of petrochemicals, Chemicals from methanol and synthesis gas, Chemicals from ethane, ethylene and acetylene, Ethylene dichloride Chemicals from propane and propylene, Chemicals from butanes, butanes pentanes and pentanes, Chemicals from aromatics, Future of petrochemicals, Ecology and Energy crises, Trends in petrochemicals industry.

Unit 10: Environmental Technology:

Selection of unit operations and processes - Principal type of Reactors, Screening - Mixing - Coagulation and Flocculation, Sedimentation, filtration, Chemical precipitation, adsorption, Isotherms – Disinfection – Factors Influencing - Breakpoint chlorination – Dechlorination, Kinetics of Biological growth - Suspended and attached growth processes - Aerobic and Anaerobic - Determination of kinetic coefficients.

ARCHITECTURAL ASSISTANTSHIP

Syllabus

Unit 1: History of Architecture:

Architectural character and style: Egyptian Architecture – Temples and Tombs – Great Pyramids – Cult temple. Greek Architecture – Classical orders-Optical illusion – Golden Rectangle Theory – Sport arenas. Roman Architecture – Temples – Construction Techniques – Public Baths – Important buildings.

Indian Architecture – Ancient India – Indus Valley Civilization - Mohenjodaro, Harappa – Culture and Pattern of Settlement – Buddhist – Stupas ,Viharas and Chaityan Halls – Hindu Architecture – Dravidian and Aryan – Islamic Architecture – Imperial, Provincial and Mughal – Important buildings and features.

Contemporary Architecture – Important Works of Famous Architects

Unit 2: Theory of Architecture:

Introduction to Architecture – Definitions of Architecture – Context for Architecture – Functional aspects of Architecture – Meaning and Interpretation of Architectural Factors like architectural expression, symbolism, character and style, movements, philosophies, ideologies and theories.

Ordering Elements of Architecture – Point, line, plane, form, shape, pattern, light, texture – Effects of Color in Architecture – Color Symbolism – effects of the geometrical forms and their derivatives like sphere, cube, pyramid, cylinder and cone – Ordering Principles of Architecture – proportion, scale, balance, rhythm, axis, symmetry, hierarchy, datum, unity, harmony and dominance.

Organization of Form and Space – spatial relationships – spatial organization – form – space relationship.

Circulation – Components of Building Circulation – Approach – Entrance – Configuration of Path – Path space relationship – Form of Circulation Spaces

Unit 3: Building Materials:

Soil-Lime – Rural building materials – bricks and clay products – Timber – soft and hard wood – seasoning and preservation – commercial forms – Qualitative aspects of a good timber products –artificial timber

Cement – properties and types – Manufacturing process – Tests for cement

Concrete – Ingredients – grading of aggregates – Mixing, transportation and placing of concrete – Curing of concrete – Joints in concrete – Light weight concrete

Glass – Composition of glass – Manufacturing – Types – Properties – Applications

Protective Coatings – paints and varnishes – Ferrous and Non ferrous meta's – properties and applications – Plastics – Properties and Uses – sealants and adhesives.

Unit 4: Building Construction and Project Management:

Building components – Floors, Walls, Roofs, water proofing etc., Technical terms and functions – **Details of Foundation Systems** – types of foundations – suitability to soil types – **Stone masonry** – technical terms, types of finishes, types of bonds and specifications – **Brick Masonry** – technical terms – types of bricks – types of bonds – basics of brick laying – defects and maintenance issues – **Timber Joints** – Types and details – Windows – Doors – Ventilators – Types and Details – Staircases – Types – Design and Details

Project planning – Project scheduling and project controlling, Methods of planning and programming, Human aspects of project management, work breakdown structure, Life cycle of a project, disadvantages of traditional management system – **Elements of Network** – Event, activity, dummy, network rules, graphical guidelines for network, numbering of events

Critical Path Method and Pert Analysis – CPM network analysis & PERT time estimates, time computation & network analysis – Project Time reduction and optimization – Project cost, Indirect project cost, direct project cost, slope of the direct cost curve, Total project cost and optimum duration, contracting the network for cost optimization, steps in cost – time optimization.

Unit 5: Building Services, Climatology and Acoustics:

Electrical Services: Wiring systems – wiring materials – transportation and distribution of power – electrical terms and units – **Lighting:** Principles of lighting – Principles of illumination – Characteristics and application of different types of lamp – Lighting Design and Application in Building.

Air Conditioning: Basic refrigeration principles – Air conditioning system for buildings – Window handling unit – Split unit – Central Air conditioning plant

Fire Safety measures: NBC planning consideration – NBC guidelines for the design of lift, lobbies, stairway, ramp and fire escape staircase – Fire Detection and Fire Fighting Installation

Intelligent Buildings – Concept and definitions

Climatology – factors that determine the climate of a place – Components of climate – Classification of climate – Climate characteristics – Human Body heat balance – Factors Affecting Thermal Comfort –Effective Temperature – Design of solar shading devices – Movement of sun – sun path diagram – shadow angles – Heat flow through buildings – Transfer of heat through solids – surface resistance and air cavities – Impact of air movements – Wind – Stack Effect – Venturi Effect – Use of Courtyards – effects of topography on wind pattern – air currents around the buildings – Design strategies in various climatic conditions .

Acoustics – Fundamentals – sound waves, frequency, wave length – decibel required for various spaces as prescribed by National Building Code, India – Human ear characteristics tone structure – Sound transmission and absorption – acceptable noise level – reverberation time – Sabine's formula– echo – absorption co-efficient.

Unit 6: Environmental studies

Quantity of water – need for protected supply – demand – forecasting population for towns and cities – sources of water – intake types and reservoirs – **Quality of water** – Impurities in water – Potable water standards laid down by World Health Organization – Water borne diseases – Treatment of water – Sedimentation and filtration – Hardness – Chlorination.

Water Supply and Distribution System – Different systems of supplying – Different layouts of distribution system – Appurtenances used in the distribution system – wastage of water detection methods.

Collections and conveyance of sewage – sanitation purpose – definitions of various terms – Properties of sewage – Methods of carrying sewage – Treatments and disposal – Septic tank – Soak pits – Oxidation ponds.

Environmental Pollution and Control – water, land and air pollution – conservation of water resources – rain water harvesting – classification of air pollutants – effects of air pollution on human beings, animals, plants and materials – acid rain – Renewable energy resources – solar wind – thermal and Bio-Mass energy.

Unit 7: Landscape and Ecology

Basics of ecology and ecological balance – Global warming – Greenhouse effects – Acid rain – Ozone depletion – Reclamation process and environmental impact assessments – Common landscape terms.

Elements of Landscape Design – Definitions – Hard and soft landscape elements – plant materials: classification, characteristics, use and application in design – use of water and landforms in landscape design – Landscape conservation.

Indoor Landscape – Functions and behavior of plants on interiors, light, air and water requirements – Drainage – Indoor plant materials – Potting – Lighting

Garden Design – History of landscape and garden design – English, Italian, Japaneses, Renaissance, Moghul styles.

Site Planning – Basics of Site planning, gradient, slopes, drainage details – aspects like circulation, distribution of built form and open spaces – aspects of micro climate – site planning standards for neighbourhood parks, children's play area, terrace gardening, Street Landscaping, Design for Waterfront Areas, housing layouts and campus development.

Unit 8: Town Planning

Planning concepts – origin of towns and cities – Neighbourhood concept – Garden City Concept – Master plan – Types of town and cities according to growth, origin and pattern – Roads and street – Classification of roads – traffic management – Parking standards.

Housing – Various agencies involved in the housing sector – Financial institutions and role in housing sector – Various income groups – Urban Land Ceiling Act – Slum Upgradation and improvement – Sites and Services schemes.

Bye-Laws and Development Control Rules – Terms and definitions – Principles of Land Uses and zoning – Salient features of Tamil Nadu Town and Country Planning Act – Multi Storey buildings and Special Buildings – Provisions for the physically challenged people.

Unit 9: Computer Application in Architecture:

Components of a PC and its working principles – Different types of computers, Computer peripherals – Basics of Computer software and graphical applications. Different file format and file management, Different I/O techniques.

Computer aided 2D Drafting – various commands used for creating a 2D – Drawing 2D Object drawing methods, editing objects and modifying their associated properties; texts; dimensioning – **3D Drafting and Modelling** – Different types of 3D modeling techniques; Solid creation; Editing; Creating complex solids; Boolean operations on solids.

View and Co-ordinate Management – Different View management techniques; Concept ofUCS' Icon management – Rendering management – Concept of shading; **Rendering**;Material mapping; Environmental attributes.

Unit 10: Professional ethics and Practice:

Architect's services – Role of an architect – scale of fees for various buildings – Guidelines of architectural design competition – Professional Code of Conduct – Role of Indian Institute of Architects – Role of Council of Architecture.

Tender – types of tender – Tender document – Concept of EMD – Opening and scrutinizing the tender – selection process – **Contract** – types and features – essential components of a contract – various types of forms used in CPWD for contract – Arbitration – Advantages

Elementary accountancy – vouchers and cash receipts – cheques and drafts – e-banking – types of bank account – Maintenance of records and files

ENGLISH

Syllabus

1. Unit I - Chaucer to Shakespeare:

Geoffrey Chaucer	:	The Book of the Duchess
Edmund Spencer	:	Epithalamion
Shakespeare	:	Sonnets (8, 15, 24, 30, 37, 40, 46, 76, 82, 91, 112, 116, 126, 140, 144, 147, 154)
Francis Bacon	:	of Oxford of Nobility of Travel of Friendship of Love
Ben Jonson	:	Volpone or the Fox
Christopher Marlowe	:	Dr.Faustus
Sir Jhomas More	:	Utopia
John Webster	:	The White Devil
William Langland	:	Piers the plowman
Shakespeare	:	The comedy of Errors A Midsummer Night's Dream Hamlet Henry VIII Love's Labour Lost

2. Unit 2- Jacobean to Augustan age:

John Milton	:	Paradise Regained
John Dryden	:	All for Love

Alexander pope	:	The Rape of the Lock
Andrew Marwell	:	Garden
Thomas gray	:	Elegy written in a country churchyard
Jonathan swift	:	A Tale of a Tub
Addison and Steele	:	The spectators and the coverly papers. (Essays 1-10, Macmillan Edn)
Oliver Goldsmith	:	The Deserted village
Henry Fielding	:	Joseph Andrews
Samuel Daniel	:	Christ Victoric Triumph
Sir Thomas Brown	:	The Garden of Cyrus
William Blake	:	Songs of Experience
Daniel Defoe	:	Robinson Crusoe
Jonathan Swift	:	Gulliver's Travels
Henry Vaughan	:	Regeneration

3. Unit 3 – Romantic Period:

William Wordsworth	:	The Daffodils The Solitary Reaper
Samuel Taylor Coleridge	:	Lyrical Ballads Biographia Literaria
P.B.Shelly	:	Ode to the west wind
John keats	:	Ode to Autumn
Charles Lamb	:	The Essays of Elia
		(1) Oxford in the vacation
		(2) New year's Eve
		(3) Dream children: A Reverie
		(4) The price of chimney-sweeper
		(5) My Relations
Byron	:	Prometheus
Jane Austen	:	Emma
Walter Scott	:	The Talisman
William Hazlit	:	Characters of Shakespeare's plays.
Emily Bronte	:	Wuthering Heights

4. Unit 4 – Victorian age:

Tennyson	:	The princess:A Medley
Robert Browning	:	Men and Women Andrea Del Sarto
Mathew Arnold	:	Rugby Chapel Dover beach.

D.G.Rosetti	:	The Blessed Damozel
George Eliot	:	Romola
W.M Thackeray	:	Vanity Fair
R.L.Stevenson	:	Treasure Island
John Ruskein	:	Sesame and Lilies
Charles Dickens	:	A Tale of two cities.

5. Unit 5 – Modern and Contemporary Periods:

W.B.Yeats	:	Sailing to Byzantium
Thomas Hardy	:	The Woodlanders.
Virginia Woolf	:	Mr.Bennet and Mrs.Brown
A.L.Huxley	:	Time Must Have a Stop
E.M.Forster	:	Where Angels Fear to Tread
T.S.Eliot	:	Murder in Cathedral
C.P.Snow	:	Corridors of Power
G.B. Shaw	:	The Devil's Disciple
Ezra Pound	:	The Pisan Cantos
Oscar Wilde	:	The Importance of Being Earnest

6. Unit 6 – American Literature:

Whitman	:	When Lilacs Last in the Dooryard Bloom'd
H.W.Long Fellow	:	The May Queen
Edgar Allam Poe	:	The Haunted Palace To my Mother The Lake
Emily Dickinson	:	A something in a Summer's Day Bless God, he went as soldier's How happy is the little Stone This is my Letter to The World.
Robert Frost	:	Blue Berries
Wallace Stevens	:	The Snow man
Emerson	:	The American Scholar
Henry James	:	The lesson of the master
O'Neill	:	The Great God Brown
Hawthorne	:	A House of the Seven Gables
Edward Albe	:	The American Dream
Alice Walker	:	By the light of my Father's smile
Mark Twain	:	The Adventures of Tom Sawyer
Earnest Hemingway	:	The Old Man and The Sea

7. Unit 7 – Indian and English Literature:

Nissin Ezekiel	:	Night of the Scorpion
A.K. Ramanujam	:	A River
R.Parthasarathy	:	Lines for a Photograph
Toru Dutt	:	Our Casuarina Tree
Sarojini Naidu	:	The Soul's Prayer
Anita Desai	:	Where shall we go for this summer?
Badal Surcar	:	Evam Indrajit
Sri Aurobindo	:	Rose of God.
Arundhati Roy	:	The God of Small Things
Mulk Raj Anand	:	Untouchable
Deshpande	:	The Dark Holds No Terror
Kirish karnard	:	Tugulaq

8. Unit 8 – Language and Linguistics:

Family of Indo European Languages
Historical Linguistics
LSRW
Theories of Language acquisition
Dialects
Phonology
Affixes
Derivational and inflectional affixes
Morphemes
Acronyms
Phrase and structures
Phonetics and phonology
Minimal Pairs
Sociolinguistics
Semantics and Pragmatics
Neurolinguistics
Dichotic listening
Lingua franca
Jargon

9. Unit 9 – Criticism and Literary Theories:

Plato	:	Republic
Francis Bacon	:	The Advancement of learning
Samuel Johnson	:	On fiction Preface to Shakespeare
S.T Coleridge	:	Biographia Literaria
Mathew Arnold	:	The function of criticism at the present time
I A Richards	:	Practical Criticism

Northrop Frye	:	The critical path
T.S.Eliot	:	Hamlet and his Problems
I A Richards	:	Principles of Literary Criticism
Rene Wellek	:	Concepts of Criticism
Aristotle	:	Poetics
Ezra Pound	:	The ABC of Reading
Wayne C. Booth	:	The Rhetoric of fiction
Empson	:	Seven types of Ambiguity

10. Unit 10 – Post Colonial Literature and European Literature in Translation:

Atwood	:	Surfacing
Lawrence	:	The Fire Dwellers
P.K.Page	:	Adolescence
Chinua Achebe	:	Arrow of God
Wole Soyinka	:	A Dance of the Forests
Wilfrered Campbell	:	The Winter Lakes
A.G.Smith	:	The White House
Ondaatje	:	There's a trick with a knife I'm learning to do
George Ryga	:	Portrait of Angelica In the shadow of the vulture
Ibsen	:	The lady from the sea
Moliere	:	The comic pastoral
Sir Thomas More	:	The Four Last Things

MATHEMATICS

Syllabus

Unit-1: Real Analysis:

Ordered sets–Fields–Real field–The extended real number system–The complex field–Euclidean space–Finite, Countable and uncountable sets – Limits of functions – Continuous functions – Continuity and compactness–Continuity and connectedness – Discontinuities – Monotonic functions –Equi-continuous families of functions, Stone-Weierstrass theorem– Cauchy sequences –Some special sequences – Series – Series of nonnegative terms – The number e – The root and ratio tests – Power series – Summation by parts – Absolute convergence – Addition and multiplication of series – Rearrangements, The Derivative o f a Real Function – Mean Value Theorem – The Continuity of Derivatives – L'Hospital's Rule – Derivatives of Higher Order – Taylor's Theorem – Differentiation of Vector valued functions– Some Special Functions – Power Series – The Exponential and Logarithmic functions – The Trigonometric functions–The algebraic completeness of the complex field – Fourier series - The Gamma function– The Riemann - Stieltjes Integral – Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector–valued functions –Rectifiable curves.

Unit-2: Complex Analysis:

Spherical representation of complex numbers – Analytic functions–Limits and continuity – Analytic Functions – Polynomials – Rational functions – Elementary Theory of Power series–Sequences–Series–Uniform Convergence–Power series–Abel's limit functions– Exponential and Trigonometric functions – Periodicity – The Logarithm–Analytical Functions as Mappings – Conformality – Arcs and closed curves – Analytic functions in Regions – Conformal mapping – Length and area – Linear transformations – Linear group – Cross ratio – symmetry – Oriented Circles – Families of circles – Elementary conformal

mappings – Use of level curves – Survey of Elementary mappings – Elementary Riemann surfaces–Complex Integration – Fundamental Theorems – Line Integrals – Rectifiable Arcs– Line Integrals as Arcs–Cauchy's Theorem for a rectangle and in a disk–Cauchy's Integral Formula – Index of point with respect to a closed curve – The Integral formula – Higher order derivatives – Local properties of analytic functions – Taylor's Theorem – Zeros and Poles – Local mapping – Maximum Principle–The General form of Cauchy's Theorem – Chains and Cycles – Simple connectivity Homology – General statement of Cauchy's theorem – Proof of Cauchy's theorem – Locally exact differentials –Multiply connected regions – Calculus of residues – Residue Theorem – Argument Principle – Evaluation of definite Integrals–Harmonic Functions – Definition and basic properties – Mean-value Property – Poisson's formula – Schwarz's Theorem – Reflection Principle – Weierstrass's theorem – Taylor's series- Laurent series.

Unit-3: Algebra:

Another counting principle – Sylow's theorems – Direct products – Finite abelian groups, Polynomial rings – Polynomials over the rational field – Polynomial rings over commutative rings– Extension fields – Roots of polynomials – More about roots – The element of Galois theory – Finite fields – Wedderburn's theorem on finite division rings – Theorem of Frobenius– The algebra of polynomials – Lagrange Interpolation – Polynomial ideals – The prime factorization of a polynomial – Commutative rings – Determinant functions– Permutations and the uniqueness of determinant – Classical adjoint of a matrix – Inverse of an invertible matrix using determinants–Characteristic values – Annihilating polynomial – Invariant subspaces – Simultaneous triangulation – Simultaneous diagonalization – Direct sum decompositions–Vector spaces Bases and dimension Subspaces –Matrices and linear maps –Rank nullity theorem –Inner product spaces– Orthonormal basis– Gram-Schmidt orthonormalization process– Eigen spaces– Algebraic and Geometric multiplicities –Cayley-Hamilton theorem–Diagonalization –Direct sum decomposition –Invariant direct sums –Primary decomposition theorem– Unitary matrices and their properties– Rotation matrices– Schur, Diagonal and Hessenberg forms and Schur decomposition – Diagonal and the general cases–Similarity Transformations and change of basis– Generalised eigen vectors– Canonical basis– Jordan canonical form –Applications to linear differential equations –Diagonal and the general cases – An error correcting code –The method of least squares –Particular solutions of non–homogeneous differential equations with constant coefficients –The Scrambler transformation.

Unit-4: Topology:

Topological spaces – Basis for a topology – Product topology on finite Cartesian products –Subspace topology–Closed sets and Limit points – Continuous functions – Homeomorphism – Metric Topology – Uniform limit theorem–Connected spaces – Components – Path components – Compact spaces – Limit point compactness – Local compactness–Countability axioms – T1-spaces – Hausdorff spaces – Completely regular spaces –Normal spaces–Urysohn lemma – Urysohn metrization theorem – Imbedding theorem – Tietze extension theorem – Tychonoff theorem.

Unit-5: Measure Theory and Functional Analysis:

Measure Theory: Lebesgue Outer Measure– Measurable Sets–Regularity–Measurable Functions–Boreland Lebesgue Measurablity–Abstract Measure-Outer Measure–Extension of a Measure –Completion of a Measure–Integrals of simple functions-Integrals of Non Negative Functions–The GeneralIntegral–Integratiion of Series–Riemann and Lebesgue Integrals– Legesgue Differentiation Theorem– Integration and Differentiation–The Lebesgue Set–Integration with respect to a general measure Convergence in Measure–Almost Uniform convergence– Signed measures and Hahn Decomposition – Radon-Nikodym Theorem and its applications– Measurability in a product space–The Product measure and Fubini's Theorem.

Functional Analysis: Banach spaces – Continuous linear transformations–The Hahn-Banach theorem – The natural imbedding of N in N** – The open mapping theorem – Closed graph theorem – The conjugate of an operator – Uniform boundedness theorem–Hilbert Spaces – Schwarz inequality – Orthogonal complements – Orthonormal sets –Bessel's inequality – Gram-Schmidt orthogonalization process – The conjugate space H*– Riesz representation theorem–The adjoint of an operator – Self-adjoint operators – Normal and unitary operators –Projections–Matrices – Determinants and the spectrum of an operator – spectral theorem – Fixed point theorems and some applications to analysis.

Unit-6: Differential Equations:

Ordinary Differential Equations:

Second order homogeneous equations – Initial value problems – Linear dependence and independence – Formula for Wronskian–Non-homogeneous equations of order two – Homogeneous and non-homogeneous equations of order – Annihilator method to solve a non- homogeneous equation–Initial value problems for the homogeneous equation – Solutions of the homogeneous equations – Wronskian and linear independence – Reduction of the order of a homogeneous equation–Linear equation with regular singular points – Euler equation –Second order equations with regular singular points – Solutions and properties of Legendre and Bessel's equation– Equations with variables separated – Exact equations – Method of successive approximations – Lipschitz condition–Convergence of the successive approximations.

Partial Differential Equations:

Integral surfaces passing through a given curve – Surfaces orthogonal to a given system of surfaces – Compatible system of equations – Charpit's method–Classification of second order Partial Differential Equations – Reduction to canonical form – Adjoint operators – Riemann's method– One-dimensional wave equation – Initial value problem – D'Alembert's solution –Riemann – Volterra solution – Vibrating string – Variables Separable solution –Forced vibrations – Solutions of non-homogeneous equation – Vibration of a circular membrane– Diffusion equation – Solution of diffusion equation in cylindrical and spherical polar coordinates by method of Separation of variables – Solution of diffusion equation by Fourier transform–Boundary value problems – Properties of harmonic functions – Green's function for Laplace equation – The methods of images – The eigen function method.

Unit-7: Mechanics and continum Mechanics:

Mechanics:

The Mechanical system– Generalized coordinates – Constraints – Virtual work – Energy and Momentum derivation of Lagrange's equations– Examples– Integrals of the motion Hamilton's principle – Hamilton's equations – Other variational principle– Hamilton principle function – Hamilton-Jacobi equation – Separability – Differential forms and generating functions – Special transformations– Lagrange and Poisson brackets.

Continums Mechanics:

Summation convention – Components of a tensor – Transpose of a tensor –Symmetric and anti-symmetric tensor – Principal values and directions – Scalar invariants–Material and spatial descriptions – Material derivative – Deformation – Principal strain – Rate of deformation –Conservation of mass – Compatibility conditions–Stress vector and tensor – Components of a stress tensor – Symmetry – Principal stresses – Equations of motion – Boundary conditions– Isotropic solid – Equations of infinitesimal theory – Examples of elastodynamics elastostatics– Equations of hydrostatics – Newtonian fluid – Boundary conditions – Stream lines examples of laminar flows – Vorticity vector – Irrotational flow.

Unit-8: Mathematical Statistics and Numerical Methods:

Mathematical Statistics:

Sampling distributions – Characteristics of good estimators – Method of moments –Maximum likelihood estimation – Interval estimates for mean, variance and proportions–Type I and type II errors - Tests based on Normal, t, X^2 and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit–Method of least squares –Linear regression – Normal regression analysis –Normal correlation analysis – Partial and multiple correlation - Multiple linear regression–Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design–Covariance matrix – Correlation matrix – Normal density function –Principal components – Sample variation by principal components – Principal components by graphing.

Numerical Methods:

Direct methods: Gauss elimination method – Error analysis– Iterative methods: Gauss-Jacobi and Gauss-Seidel – Convergence considerations – Eigen value Problem: Power method–Interpolation: Lagrange's and Newton's interpolation – Errors in interpolation –Optimal points for interpolation–Numerical differentiation by finite differences –Numerical integration: Trapezoidal, Simpson's and Gaussian quadratures – Error in quadratures–Norms of functions – Best approximations: Least squares polynomial approximation– Approximation with Chebyshev polynomials – Piecewise linear and cubic Spline approximation–Single-step methods: Euler's method –Taylor series method – Runge-Kutta method of fourth order – Multistep methods: Adams-Bashforth and Milne's methods– Linear two point BVPs: Finite difference method–Elliptic equations: Five point finite difference formula in rectangular region –truncation error; One-dimensional parabolic equation: Explicit and Crank-Nicholson schemes; Stability of the above schemes - One-dimensional hyperbolic equation: Explicit scheme.

Unit-9: Differential Geometry and Graph Theory:

Differential Geometry:

Representation of space curves – Unique parametric representation of a space curve – Arc-length – Tangent and osculating plane – Principal normal and bi-normal – Curvature and torsion – Behaviour of a curve near one of its points – The curvature and torsion of a curve as the intersection of two surfaces–Contact between curves and surfaces – Osculating circle and Osculating sphere – Locus of centres of spherical curvature – Tangent surfaces, involutes and evolutes – Intrinsic equations of space curves – Fundamental existence theorem – Helices–Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on surfaces – Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface – Direction coefficients on a surface–Families of curves – Orthogonal trajectories – Double family of curves – Isometric correspondence – Intrinsic properties – Geodesics and their differential

equations – Canonical geodesic equations – Geodesics on surface revolution–Normal property of geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesic parallels – Geodesic curvature – Gauss-Bonnet theorem – Gaussain curvature – Surfaces of constant curvature.

Graph Theory:

Graphs and subgraphs: Graphs and simple graphs – Graph isomorphism– Incidence and adjacency matrices – Subgraphs – Vertex degrees – Path and Connection cycles – Applications: The shortest path problem – Trees: Trees - Cut edges and bonds - Cut vertices– Cayley's formula–Connectivity: Connectivity – Blocks – Euler tours and Hamilton cycles: Euler tours – Hamilton cycles – Applications: The Chinese postman problem–Matchings: Matchings - Matching and coverings in bipartite graphs– Perfect matchings – Edge colorings: Edge chromatic number - Vizing's theorem– Applications: The timetabling problem–Independent sets and cliques: Independent sets-Ramsey's theorem-Turan's theorem-Vertex colorings: Chromatic number-Brook's theorem-Hajos' conjecture– Chromatic polynomials– Girth and chromatic number– Planar graphs: Plane and planar graphs – Dual graphs– Euler's formula– Bridges – Kuratowski's Theorem – The Five color theorem and the four color conjecture – Non Hamiltonian planar graphs.

Unit-10: Mathematical Programming and Fluid Dynamics:

Mathematical Programming:

Linear programming: Formulation and graphical solutions – Simplex method – Transportation and Assignment problems– Advanced linear programming**:** Duality – Dual simplex method – Revised simplex method – Bounded variable technique– Integer programming: Cutting plane algorithm – Branch and bound technique – Applications of integer programming–Non-linear programming: Classical optimization theory : Unconstrained problems –Constrained problems –Quadratic programming– Dynamic programming: Principle of optimality – Forward and backward recursive equations – Deterministic dynamic programming applications.

Fluid Dynamics:

Kinematics of fluids in motion: Real and ideal fluids – Velocity–Acceleration – Streamlines – Pathlines – Steady and unsteady flows – Velocity potential – Vorticity vector – Local and particle rates of change – Equation of continuity – Conditions at a rigid boundary–Equations of motion of a fluid: Pressure at a point in a fluid – Boundary conditions of two inviscid immiscible fluids– Euler's equations of motion – Bernoulli's equation – Some potential theorems –Flows involving axial symmetry–Two dimensional flows:Two-dimensional flows – Use of cylindrical polar co-ordinates – Stream function, complex potential for two-dimensional flows, irrotational, incompressible flow –Complex potential for standard two-dimensional flows –Two dimensional image systems – Milne-Thomson circle theorem – Theorem of Blasius–Conformal transformation and its applications**:** Use of conformal transformations – Hydro-dynamical aspects of conformal mapping -Schwarz Christoffel transformation – Vortex rows–Viscous flows: Stress – Rate of strain – Stress analysis – Relation between stress and rate of strain– Coefficient of viscosity – Laminar flow – Navier-Stokes equations of motion –Some problems in viscous flow.

PHYSICS

Syllabus

Unit 1: Mathematical Methods:

Differential Equations: recurrence formulae for $J_n(x)$ – generating function for $J_n(x)$ Hermite differential equation Hermite's polynomials – Generating function of Hermite polynomials Recurrence formulae for Hermite polynomials – Rodrigue's formula –Complex variables: analytic function – C-R differential equations – C-R equations in polar form – Laplace's equation – examples – Cauchy's integral Theorem and formula – Taylor's series – Laurent's series – Singularities of an analysis function – Residues and their evaluation – Cauchy residue theorem – Evaluation of definite integrals (trigonometric functions of $\cos\theta$ and $\sin\theta$ only) Group theory: concept of a group – Abelian group – Generators of finite group – Cyclic groups Group multiplication table – Rearrangement theorem – Sub groups – Lagrange's theorem for finite group conjugate elements and classes – Group of symmetry of an equilateral triangle Group of symmetry of square – Representation of a group – Reducible and irreducible representation – Schur's lemmas– Orthogonality theorem- Tensor, beta and gamma functions: scalars, Contravariant and covariant vectors – Tensors of higher rank – Algebraic operation of tensors – Mixed tensor – Symmetric and anti-symmetric tensors – Quotient law - Beta and Gamma functions: Definitions – Symmetry property of Beta function – Other forms of Beta function – Evaluation of Gamma function – Other forms of Gamma function – Relation between Beta and Gamma functions - Examples.

Unit 2: Classical Mechanics and Relativity:

Lagrangian formulation**:** Generalized coordinates – Mechanics of a particle and system of particles (momentum and energy) D'Alemberts principle – Lagrange's equations – Applications (linear harmonic oscillator, simple pendulum isotropic oscillator and electrical circuit) Hamilton's equations – Applications (simple pendulum, compound pendulum and 2D harmonic oscillator) – Deduction of Hamilton's principle – Hamilton's variational principle – Principle of Least action. Canonical transformations: Equation of canonical transformations – Infinitesimal contact transformations - Lagrange and Poisson brackets as Canonical invariants – Equations of motion in Poisson bracket form- Jacobi's identity – Relation between Lagrange and Poisson brackets – Action angle variables – Euler's angles – Angular velocity of a rigid body – Euler's equation of motion- Relativity**:** Einstein's Mass-Energy relation – Relation between momentum and energy – Four vectors – Four velocity – Energy – Momentum four vectors – Four force Relativistic classification of particles – Relativistic Lagrangian, Hamiltonian function relativistic Lagrangian and Hamiltonian of a charged particle in an E.M field.

Unit 3: Quantum Theory and its Applications:

General Principles of Quantum Mechanics**:** Wave packet – Time dependent and time independent Schr•dinger equation – Linear vector space – Linear operator – Eigen function and Eigen values – Hermitian operator – Postulates of Quantum Mechanics – Simultaneous measurability of observables – General uncertainty relation – Dirac's notation-Applications: Square well potential with rigid walls and finite walls – Square potential barrier – Alpha emission – Bloch waves in a periodic potential – Kronig–Penny square-well periodic potential Linear harmonic oscillator: Schrodinger method – Operator method – Delta function – Particle moving in a spherically symmetric potential – System of two interacting particles – Rigid rotator Hydrogen atom – Hydrogen orbitals-Angular Momentum: The angular momentum operators Spin vectors for Spin–(1/2) system – Addition of angular momenta-Time independent and dependent Perturbation theory- Basic concepts – Non degenerate energy levels – Anharmonic oscillator: First-order correction – Ground state of Helium – Effect of electric field on the ground state of hydrogen –– Transitions to continuum states – Absorption and emission radiation Einstein's A and B coefficients – Selection rules-Theory of Scattering**:** Scattering cross-section Scattering by a central potential: partial wave analysis – Significant number of partial waves Scattering by an attractive square-well potential – Breit-Wiger formula – Scattering length Expression for phase shifts – Integral equation – The Born approximation – Scattering by screened Coulomb potential – Validity of Born approximation – Laboratory and centre of mass co-ordinate system.

Unit 4: Electromagnetic Theory:

Electrostatics– Electric charge-electric charge density-Coulomb's law-Electric intensity-Electric potential-Gauss law- Applications-Boundary value problems in electrostatics –Methods of separation variables in Cartesian co-ordinates. Magneto statics-Ampere's circuital law-Magnetic scalar potential-Magnetic vector potential-Magnetization and Magnetization current-Magnetic intensity-Magnetic susceptibility. Equation of continuity - Displacement current-Maxwell's equation- Derivations-energy in electromagnetic fields-(poynting's theorem).Maxwell's equation in terms of electromagnetic potentials-Concept of gauge-Lorentz gauge. Plane electromagnetic wave and their propagation-Interaction of electromagnetic wave with matter on microscopic scale. Retarded potentials-Radiation from a linear antenna.

Unit 5: Thermodynamics and statistical mechanics:

Thermodynamics as phenomenological science – Thermodynamic systems – Closed, open, isolated systems – Thermodynamic processes – Adiabatic, isothermal, isochoric, isobaric, isentropic, cyclical and free expansion processes – Reversible, irreversible and Quasi-static processes – Equation of state – Intensive and extensive variables – The *P-V* diagram. Conversion of work into heat and vice-versa – Efficiency – Kelvin-Planck statement of the second law of thermodynamics – Clausius statement of the second law – Carnot cycle -Carnot refrigerator – Carnot's theorem and corollary. Equation of state of a gas from Avogadro's law – Ideal gas equation – Specific heat, internal energy and enthalpy of an ideal gas – Entropy change of an ideal gas – Reversible adiabatic process – Reversible isothermal process. Concept of entropy – Entropy of an ideal gas – The *T-S* diagram – Entropy, reversibility and irreversibility. Microstate and Macrostate of macroscopic system, Phase space and Phase space density, Liouville theorem. Canonical ensemble canonical partition function.-Grand canonical ensemble- Density operator, Spin statistics connection, Grand partition function for ideal Bose and Fermi gases, Bose-Einstein, Fermi-Dirac and Maxwell-Boltzmann distributions, Application to Black body radiation: Bose theory(a) Debye theory of specific heat (b) Bose-Einstein condensation-Phase transitions.

UNIT 6: Atomic and Molecular Physics:

Electromagnetic spectrum – Absorption or Emission of radiation – Line width- Natural line broadening-Doppler broadening –Pressure broadening – Removal of line broadening - X-ray Spectra – Emission and absorption spectra of X-rays. Regular and irregular doublet laws – X-ray satellites – Photoelectron spectroscopy– Ultraviolet photoelectron spectrometers – XPS techniques and Chemical information from photoelectron spectroscopy – Auger electron spectroscopy. Infrared Spectroscopy-Vibrational Energy of a Diatomic molecule – The Diatomic Vibrating Rotator – The Vibrations of Polyatomic molecules – Rotation-Vibration spectra of Polyatomic molecules – Analysis by Infra-red Techniques- IR spectrophotometer Fourier Transform- IR spectrophotometer- Applications – Frank-Condon principle and dissociation energy**.** Raman Spectroscopy**-**

Theories of Raman scattering – Rotational Raman Spectra – Vibrational Raman Spectra– Mutual Exclusion principle – Raman Spectrometer Polarization of Raman Scattered light – Structural determination from Raman and IR spectroscopy - Near IR-FT-Raman spectroscopy. Laser *Spectroscopy*- Basic principles: Comparison between conventional light sources and lasers-Saturation-Excitation methods-Detection methods-Laser Wavelength Setting-Doppler Limited Techniques. Nuclear Magnetic Resonance Spectroscopy- Basic principles – Magnetic resonance – Relaxation processes– Pulsed (Fourier Transform) NMR – Wide line NMR spectrometers – Spectra and molecular structure – Chemical shifts – Spin-spin coupling – Integration – Applications. - Principles of Mossbauer spectroscopy – Chemical shifts – Quadrupole splitting and Zeeman splitting. Applications of Mossbauer spectroscopy.

Unit 7: Condensed Matter Physics:

Elements of X-ray Crystallography and defects in solids- Miller indices – Point groups – Space group – Reciprocal lattice – Bragg's law interpretation – Structure factor – Fcc and Bcc structures – Electron density distribution experimental techniques for crystal structure studies (powder, Laue, rotation crystal method)- Electron and neutron diffraction methods – Point defects – Color centres – Line defects – Edge dislocation – Screw dislocation – Dislocation method. Semiconductors- Intrinsic semiconductor and extrinsic semiconductor – Mobility, drift velocity and conductivity of intrinsic and extrinsic semiconductors – Carrier concentration in intrinsic and extrinsic semiconductors - Band model. Magnetic properties- Magnetic permeability – Theory of diamagnetism – Langevin's theory of paramagnetism – Weiss theory – Paramagnetic susceptibility of a solid – Calculation of susceptibility – Quantum theory of paramagnetism determination of susceptibility – Para and diamagnetic materials – Ferromagnetism Spontaneous magnetism in ferromagnetism – Curie-Weiss law – Ferromagnetic domains – domain theory Antiferromagnetism – Structure of ferrites-Dielectric properties- Microscopic concepts of polarization – Langevin's theory of polarization in polar dielectrics – Local fields in liquids and solids – Evaluation of local fields for cubic structure –Clausius-Mossotti relation – Lorentz formula – Ferroelectricity – Dipole theory of ferroelectricity - Classification of ferroelectric materials – Antiferroelectricity – Piezoelectricity – The complex dielectric constant and dielectric loss .

Unit 8: Nuclear and Particle Physics:

Elements of nuclear Structure and Systematics**:** Theories of nuclear composition (proton-electron theory, proton-neutron theory) – Mass spectroscopy – Bainbridge and Jordan mass spectrograph – Nier's mass spectrometer – Deuteron – Magnetic and quadra pole moment of deuteron – Ground state of deuteron – Excited state of deuteron – The meson theory of nuclear force – Yukawa potential -Properties of Stable Nuclei and Nuclei models- Semi empirical mass formula – Nuclear models – Shell models – Magic numbers – Single particle model – Collective model – liquid drop model – Magnetic moments and shell model – Prediction of angular momenta of nuclear ground state-Nuclear Reaction Studies. Conservation laws for nuclear reactions –Nuclear energy – Photo nuclear reaction – fission process – cross sections – Bohr Wheeler theory -Elementary Particles**-** Classification of elementary particles – Fundamental interactions – Electromagnetic, strong, weak gravitational interactions – Parameters of elementary particles – Conservation laws - Quarks theory.

Unit 9: Electronics:

Semiconductor Diodes: Operation, characteristics and applications of Zener and Avalanche, Varactor, Schottky- barrier, Tunnel diodes; Construction, operation and Characteristics of BJT, FET and MOSFET- FET amplifier - Negative Resistance and Devices- Uni-Junction transistor and its characteristics – UJT relaxation oscillator – UJT applications – Tunnel diode characteristics and applications – Gunn Diode mechanism – Characteristics and applications SCR – characteristics and applications. IC- Fabrication Technology- Monolithic IC process refining and growth of silicon crystals – Silicon wafer - Operational Amplifier- Characteristics of ideal and practical Op Amps – Parameters of Op Amp – Theory of inverting amplifier – virtual ground – Theory of non-inverting amplifier –Sinusoidal oscillators –Phase shift oscillator – Wein Bridge oscillator – Crystal oscillator – Multi vibrator – Comparator – Schmitt trigger – Square wave and triangular wave generators – Active filters-Digital Electronics Fundamentals**-** Number systems – Binary arithmetic – 8421 code-excess – grey code – ASCII code – Logic gates and logic circuits – Boolean algebra – De Morgan's theorems – Arithmetic circuits – Simplification using Karnaugh's map – problems.

Unit 10: Experimental Physics:

Measurement of energy and time using electronic signals from the detectors and associated instrumentation – Signal processing – A/D conversion – Multichannel analyzers – Time-of-flight technique – Coincidence Measurements – True to chance ratio – Correlation studies. Error Analysis and Hypothesis testing – Propagation of errors – Plotting of Graph – Distributions – Least squares fitting – Criteria for goodness of fits – Chi square test- Measurement of fundamental constants: *e, h, c* – Measurement of high and low resistances, inductance and capacitance – Detection of X-rays, Gamma rays, charged particles, neutrons – Ionization chamber – Proportional counter – GM counter – Scintillation detectors – Solid State detectors – Vacuum Techniques – Basic idea of conductance, pumping speed – Pumps: Mechanical Pump – Diffusion pump – Gauges – Thermocouple gauge – Penning gauge – Pirani gauge – Hot Cathode gauge – Low temperature systems – Cooling a sample over a range up to 4 K – Measurement of low temperatures.

CHEMISTRY

Syllabus

Unit-1

Analytical Chemistry: Classification of analytical Methods — classical and instrumental. Errors and Evaluation: Definition of terms in mean and median — Types of errors, propagation of errors, accuracy and precision, least squares analysis, average standard deviation.

Analytical Techniques: Principle and applications of adsorption, partition, ion exchange and solvent extraction - chromatographic methods — TLC HPLC and GC. Applications of atomic, molecular and emission spectroscopy in quantitative analysis - Eleetroanalytical techniques — cyclic and stripping voltametry, polarography, TGA, DTA, and DSC. Light scattering techniques including nepelometry and Raman spectroscopy.

Unit-2

Structure and Bonding: Atomic orbitals — Types of chemical Bonds (weak and strong) intermolecular forces. Theories of bonding (VB and MO). Concept of hybridization — shapes of polyatomic molecules — VSEPR theory — Structure of simple ionic and covalent compounds — lattice energy — crystal defects — insulators and semiconductors, superconductors, Band theory of solids —Solid state reactions.

Acids and Bases : Bronsted and Lewis acids and bases, pH and pKa, acid-base concept in non aqueous media, HSAB concept, Buffer solution.

Redox Reactions: Oxidation numbers; Redox potential, electrochemical series, Redox indicators, Chemical principles involved in-extractions and purification of Iron, Copper, Lead, Zinc and Aluminium.

Unit-3

Nuclear Chemistry: Radioactive decay and equilibrium, Nuclear reactions: Q valve, cross sections, types of reactions, nuclear transmutations, fission and fusion Radioactive techniques - tracer technique, neutron activation analysis. G.M, ionization and proportional counters. Radiolysis of water — G. Value, dosimeters and Hydrated electron. **Chemistry of Non-transition**: **elements -** General properties and structure of their halides and oxides. Polymorphism carbon, phosphorus and sulphur. Synthesis, properties and structure of boranes, carboranes and metallo carboranes - Wade's rule - preparation, properties and structure of borazines & phosphazenes.

Sulphur-nitrogen compounds - oxides and oxy acids of nitrogen, phosphorous, sulphur and halogens, interhalogen and noble gas compounds. Isopoly and heteropoly acids and salts.

Unit-4

Chemistry of Transition elements: Co-ordination Chemistry of transition metal ions - Werner's theory — nomenclature and stereo chemistry of co-ordination compounds — stability constants and their determinations — CFT, splitting of d orbitals, CFSE, Jahn Teller effect, charge transfer spectra - spectrochemicai series - Term states for d_n ions, Orgel and Tanable - sugano diagram, calculation of D_q, B and â parameters.

Inorganic reaction mechanism: Inert and labile complexes - substitution reactions — trans effect — redox and electron transfer reactions. Photochemistry of chromium, ruthenium and cobalt complexes; Chemistry of _lanthanides and actinides. Metal carbonyls and metal clusters, Organometallic reagents in organic synthesis - Cayatylic reactions - (hydrogeneation, hydroformylation, isomerization and polymerization) pi-acid metal complexes.

Bioinorganic Chemistry: Metal ions in Biology, Photosynthesis, PSL, PSH, Nitrogen

fixation, Oxygen transport and storage, Hemeproteins haemoglobin, cytochrome and ferrodoxins.

Spectroscopy: Applications of nmr, nqr and esr to inorganic compounds.

Unit-5

Chirality.Differentiation of assymmetric and dyssymmetric molecules. Identification of prochiral carbons enantio and diastereoptropic hydrogens in a molecule. Stereochemistry of disubstituted four, five, and six membered saturated alicyclic molecules. Conformational analysis of mono and disubstituted cyclohexanes and piperidines. E-Z nomenclature for isomeric olefins. Stereochemistry of aliphatic nucleophilic substitutions in acyclic and bicyclic systems. Stereochemistry (specific or selective) of dihydroxylations, halogen addition, hydroborations and Diels Alder reaction of suitably substituted olefinic double bonds. Steraspecfic E-2 eliminations in erythro — threo isomers. Reduction of ring substituted cyclohexanones to cyclohexanols.

Unit-6

Mechanism of SN-1, reactions in substrates with. various types of NGP. Methods of generation and mechanisms of reactions proceeding via carbenes and nitrenes. Concreted reactions: Mechanism of electrocyclic and chelotropic reactions and sigmatropic rearrangements. Photochemical reactions: Mechanisms of Norrish — I and II types, Paterno Buchi and Barton. reactions, di-â-methane rearrangements. Rearrangements: Mechanisms of rearrangements proceedings via carbonium ions (Wagner Meerwin pinacol pinacolone and Demjanov type) and electrophilic heteroatoms (Baeyer Villiger and Curtius type). Mechanism of nucleophilic substitution in activated aryl halides. Regiochemistry of aryne generation and subsequent[additions of o, m and p-substituted aryl halides.

Unit-7

Organic synthesis: Synthesis and any di and trisubstituted benzene derivatives from any mono substituted benzene or benzene itself. Synthesis of simple compounds using C-C bond forming reactions involving Wittig, Wittig Honner, Gilmann Reagents, organolithiums, Grignards, Robinson annulation, Dickmann condensation, Knovenagel, Mannisch, Stork enamine, and Vilsmeyer reactions and umplolung. (1,3-dithane). Synthetic transformations involving Swern oxidation, Birch Wolf Kishner and metal hydride reductions, catalytic hydrogenations and reagents like tributyltin hydride, trimethylsilyl iodide, LDA, n-BuLi, Raney nickel, NBS Chromium reagents, DCC and Pd. Application of protective group concept (aldelydes, ketones and carboxylic acids) during multistep synthesis. Spectral identification of organic intermediates by IR (functional group) PMR and CMR and Mass. spectra. (simple molecules only).

Unit-8

Numbering and synthesis of un substituted (parent) and alkyl, aryl or acyl (wherever methods are available) substituted furans, pyrroles, thiophene, quionline, iso quinoline and indoles. Reactivity of these compounds towards electrophiles or nucleophiles. A study of other non benzenoid aromatics (ferrocences, azulenes, annulenes and fulvenes).

Unit 9

Quantum Chemistry: Plancks' quantum theory, Compton effect, wave particle duality, uncertainty principle, operators: linear and Hermitian, Schrodinger wave equation, postulates of quantum mechanics. Application of Schrodinger equation to particle in a box, harmonic. oscillator, rigid rotator and hydrogen atom. Angular momentum: commutation relation, spin orbit interaction, Approximation methods: variation theorem, application of variation method to harmonic oscillator, hydrogen and helium atoms. Perturbation theory — application to helium atom. Born — Oppenheimer. approximations: LCAO — MO and VB treatments of H2 molecule. Huckel theory: application to ethylene, butadiene and benzene. Calculation of electron density and bond order. Semi empirical methods: Slater orbital and HF-SCF methods.

Macromolecules: Techniques, mechanism and kinetics of polymerisation, Kinetics of copolymerisation-Molecular weights and their determination. Properties of polymers: glass transition temp. crystallinity of polymers- polymer processing techniques.

Unit-10

Chemical-Kinetics: Theories of reaction rate, collision theory, ARRT, comparison- potential energy surfaces - treatment of unimolecular reactions.

Complex reactions: simultaneous, parallel and consecutive reactions. Chain reactions: H_2_Cl_2, H_2_Br_2 branching reaction- explosion limit.

Reactins in solution: factors determining reaction rate in solution, dielectric constant and ionic strength, Kinetic isotopic effect, Linear free energy relations. Hammett and Taft equations. Homogenous Catalysis: acid base catalysis, enzyme catalysis. Heterogeneous catalysis: Adsorption, Langmuir and BET adsorption isotherms — mechanism of heterogeneous catalysis.

Thermodynamics: First and second Laws of thermodynamics - relation between c_p and c_v in terms of coefficients of expansion and compressibility. Maxwell relations- partial molar properties – Glibbs' Duhem equation - variation of chemical potential with temperature and pressure – fugacity - Third law and calculation of entropy.

Statistical thermodynamics: Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac distribution- Partition function, translational, rotational and vibrational partition function, calculation of thermodynamic functions, equilibrium constant and heat capacity from partition functions. Einstein and Debye theories of heat capacity of solids, concept of negative absolute temperature.

Non equilibrium, thermodynamics: Phenomenological laws- Onsagers' reciprocity relation - application to Diffusion potential, electrokinetic phenomena- entropy production.

Unit 11

Group theory: Symmetry elements and symmetry operations, point groups, reducible and irreducible representations — Direct product representation. Orthogonality theorem and its consequences- construction of Character Tale (C_{2v}, C_{3v} and C_{2h}) Applications: Selection rules for IR, Raman and electronic spectra, Determining Symmetries of normal vibrational modes of non linear molecules, construction of hybrid orbitals, application to electronic spectra **of** ethylene and formaldehyde.

Spectroscopy: Rotational Spectra of rigid and non-rigid diatomic rotors, simple polyatomic molecules.

Vibrational Spectra: harmonic and anharmonic oscillator, overtones, Fermi resonance - Raman Spectra. Vibration - rotation Spectra - PQR branches, parallel and perpendicular vibrations.

Electronic Spectroscopy: Spectra of diatomic •molecules- Frank condon principle-Morse function, polyatomic molecules, types of transition, solvent effects Spin resonance Spectroscopy: NMR: Origin of nmr signal, Chemical Shift, factors affecting chemical shift and spin spin coupling. NMR Spectra of simple AX and ABX type molecules. ^{13}C and ^{19}F nmr.

ESR: Origin, g-factor, hyperfine structure- Mc Connel equations, Theory and simple applications of Mossbauer and Photoelectron Spectroscopy.

Unit-12:

Electrochemistry: Ion-solvent interaction- Born treatment- solvation number and its determination Ion - ion interaction: activity co-efficient, Debye-Huckel equation for activity coefficient - limitations and extension to concentrated solutions. Ion transport: Debye Huckel Orsager equation for conductance- experimental validity. Ion association: its effect on conductance and activity coefficient.

Electrode-electrolyte interface: Structure of double layer- electrode kinetics- overvoltage. Butler — Volmer equation for one electron transfer. Corrosion and Stability of metals: construction and use of Pourbaix and Evans' diagram - Prevention of corrosion, Primary and Secondary cells- Various fuel cells.

Photochemistry: Photo physical processes- Theory of radiation less transition-fluorescence, phosphorescence, fluorescence quenching- Stern-Volmer equation, excimer, exciplexes, Quantum yield measurement, Kinetics of Photochemical reactions

Green house effect, Ozone depletion, Acid rain, Solid waste management.

INFORMATION TECHNOLOGY
Syllabus

Unit 1: Engineering Mathematics

Mathematical Logic*:* Propositional Logic; First Order Logic.

Probability*:* Conditional Probability, Mean , Median, Mode and Standard Deviation; Random

Variables; Distributions; uniform, normal, exponential, Poisson, Binomial.

Set Theory & Algebra*:* Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra.

Combinatorics*:* Permutations; Combinations; Counting; Summation; generating functions;

recurrence relations; asymptotics.

Graph Theory*:* Cut vertices & edges; covering; matching; independent sets; Coloring; Planarity; Isomorphism.

Linear Algebra*:* Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors.

Numerical Methods*:* LU decomposition for systems of linear equations; numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-Raphson Methods; Numerical integration by trapezoidal and Simpson's rules.

Calculus*:* Limit, Continuity & differentiability, Mean value Theorems, Theorems of integral calculus evaluation of definite & improper integrals, Partial derivatives, Total derivatives, maxima & minima.

Unit 2: Theory of Computation

Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Undecidability,NP completeness.

Unit 3: Digital Logic:

Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point).

Unit 4: Computer Organization and Architecture :

Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

Unit 5: Programming and Data Structures:

Programming in C; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

Unit 6: Algorithms:

Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching.

Unit 7: Operating System:

Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling,Memory management and virtual memory, File systems,I/O systems, Protection and security.

Unit 8: Databases:

ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Unit 9: Information Systems and Software Engineering:

Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

Unit 10: Computer Networks:

ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4) Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Web technologies: HTML, XML, basic concepts of client-server computing. Mobile Technologies: GSM, GPRS, Blue Tooth, Wifi, Wimax

PRODUCTION ENGINEERING

Syllabus

Unit 1: Engineering Mathematics:

Linear Algebra: Matrix algebra, Systems of linear equations, Eigen values and Eigenvectors.

Calculus: Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and Minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order equations (linear and non-linear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation. Fourier integral theorem.

Complex variables: Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

Probability and Statistics: Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions. Statistical basis for control charts – Control limits – Control charts for variables : $\overline{X}$, R Charts – Control chart for defective : p , np Chart - Control chart for defects : c charts. Correlation

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

Unit 2: Engineering Materials and Engineering Mechanics:

Engineering Materials: Structure and properties of engineering materials and their applications: effect of strain, strain rate and temperature on mechanical properties of metals and alloys; heat treatment of metals and alloys, its influence on mechanical properties.

Engineering Mechanics and strength of materials: Engineering Mechanics – equivalent force systems- laws of forces - free body Concepts, equations of equilibrium; friction – types of friction – mechanical advantage – geometrical properties of sections – kinematics and kinetics – types of motion - DAlembert's principle momentum equations of momentum – laws of conservation of momentum – coefficient of restitution. strength of materials – stress, strain and their relationship, Mohr's circle, deflection of beams, bending and shear stress, Euler's theory of columns, Theory of torsion..

Unit 3: Theory of Machines and Design:

Analysis of planar mechanisms, cams and followers; governers and fly wheels; design of elements – failure theories; design of bolted, riveted and welded joints; design of shafts, keys, spur gears, belt drives, brakes and clutches.

Unit 4: Fluid Mechanics and Thermal Engineering:

Fluid Mechanics – fluid statics, Bernoulli's equation, flow through pipes, equations of continuity and momentum; thermodynamics – zeroth, first and second law of thermodynamics, thermodynamic system and processes, calculation of work and heat for systems and control volumes; air standard cycles; basics of internal combustion engines and steam turbines; heat transfer – fundamentals of conduction, convection and radiation, heat exchangers.

Unit 5: Metal Casting and Forming

Casting Processes – types and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; solidification; design of casting, gating and risering; casting inspection, defects and remedies.

Metal Forming: – Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working – forging, rolling, extrusion, wire and tube drawing; sheet metal working processes such as blanking, piercing, blending, deep drawing, coining and embossing; analysis of rolling, forging, extrusion and wire/rod drawing; metal working defects.

Unit 6: Metal Joining Processes:

Welding Processes – manual metal arc, MIG, TIG, plasma arc, submerged arc, electroslag, thermit, resistance, forge, friction, and explosive Welding; other joining processes – soldering, brazing, braze welding; inspection of welded joints, defects and remedies; introduction to advanced welding processes – ultrasonic, electron beam, laser beam; thermal cutting.

Unit 7: Machining and Machine Tool Operations:

Basic Machine tools; machining processes-turning, drilling, boring, milling, shaping, planning, gear cutting, thread production, broaching, grinding, lapping, honing, super finishing; mechanics of machining – geometry of cutting tools, chip formation, cutting forces and power requirements, Merchant's analysis; selection of machining parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability; principles and applications of nontraditional machining processes – USM, AJM, WJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM.

Tool Engineering: Jigs and fixtures – principles, applications, and design; press tools – configuration, design of die and punch; principles of forging die design.

Unit 8: Metrology and Inspection:

Limits, fits, and tolerances, interchangeability, selective assembly; linear and angular measurements by mechanical and optical methods, comparators; design of limit gauges; interferometry; measurement of straightness, flatness, roundness, squareness and symmetry; surface finish measurement; inspection of screw threads and gears; alignment testing of machine tools.

Unit 9: Powder Metallurgy and Newer Production Processes:

Production of metal powders, compaction and sintering. Unconventional Machining Processes - electrodischarge machining – Laser beam machining – Ion beam machining – Plasma beam machining – Ultrasonic machining – Abrasive jet machining – Electrochemical and chemical machining – abrasive flow finishing –

Unit 10: quality Control, Process Analysis and Modern Manufacturing Systems:

Quality objectives - Quality control - Quality Assurance - Quality system - Sources of errors in manufacturing; process capability; tolerance analysis in manufacturing and assembly; process planning; parameter selection and comparison of

production alternatives; time and cost analysis; manufacturing technologies – strategies and selection. Computer Integrated Manufacturing: Basic concepts of CAD, CAM, CAPP, cellular manufacturing, NC, CNC, DNC, Robotics, FMS and CIM.

TEXTILE TECHNOLOGY

Syllabus

Unit 1: Raw Materials:

Natural Fibers: Cellulosic Fibers – Cotton, Linen, Flax, Jute etc. etc.; Protein Fibers – Wool, other Animal Hairs, Silk

Regenerated Fibers\Filaments: Cellulosic's – Regular Viscose, High Tenacity Viscose, Chemically modified Viscose (Cellulose acetates etc. etc.); Protein Fibers – Milk Cassin (Lanitial), Soya bean (Azlon) etc. etc.

Regular Synthetic Fibers\Filaments: Polyamides – Nylon 6, Nylon 66, Nylon 4 etc. etc.; Polyesters – Terylene, Dacaron etc. etc.; Acrylics, Mod-acrylics, Aramides, Polyethylene/Polyolefin, Polypropylene etc. etc.

Special Synthetic Fibers\Filaments: Super strong polymers – Kevlar, B Fibers, Carbon Fibers; Temperature/Flame Resistant Polymers – Neomex etc. etc.; Elastomers – Lycra etc. etc; Mineral Fibers – Asbestos, Glass, Carbon; Other special purpose fibers.

Testing and Quality Control of Fibers\Filaments – Properties, Testers/Test methods and Quality standards for fibers and filaments.

Unit 2: Fiber to Yarn Conversion.

Raw Material – need to mix cottons, the processing of blends;

The Short Staple (Cotton) - Processes – Blow room, Card, Draw frame, Comber (optional), a) Roving-frame, Ring-frame b) Rotor frame and other Open End processed, c) Compact spinning, and d) other modern spinning systems

Long staple processes – Processing of Flax, Linen, Jute and other long staple cellulosic materials; Processing of wools – Worsted and Woolen spinning

Testing and Quality Control of Yarns – Properties, Testers/Test methods and Quality standards for yarns; Tests for specific end uses

Unit 3: Yarn/Filament to Fabric.

Preparatory to Weaving – Winding, Warping and Sizeing processes Shuttle Weaving – Hand looms, Pedal looms, Power looms, Automatic looms; Primary Secondary and tertiary motions; tappet dobby and jacquard shedding; special motions of Automatic loom Shuttleless Weaving – different weft insertion systems, rapier, projectile, air jet, water jet; modifications in preparatory processes for shuttleless weaving

Knitting – Warp and weft knitting-theory and practice, Ticot and Rachell Systems-Theory and Practice, Testing of knitted fabrics – properties-test methods, end uses of knitted fabrics

Non Woven Fabric Preparation – different methods of producing non-woven fabrics, Properties of non-woven fabrics, Testing of non-woven fabrics, end uses of nonwoven fabrics

Testing and Quality Control of Fabrics – Properties, Testers/Test methods and Quality standards for gray fabrics; Tests for specific end uses.

Unit 4: Wet Processing:

Desizeing – different methods

Scouring – processes for cotton wool and silk (ceresin removal)

Mercerising (fabrics with cotton only) – Slack and taut processes

Bleaching – Different bleaching agents and processes

Dyeing – Classes of dyes, linking dye classes to different fibers, dyeing processes

Printing – Manual – Stamp and Flat screen processes; Automatic – engraved roller and screen roller systems, digital printing Testing and Quality Control of Wet processing – Process Parameters and Properties, Testers/Test methods and Quality standards for processes and finished fabrics; Tests for specific end uses.

Unit 5: Manufacture of Filament Yarns:

Pre spinning Processes – Preparation of Polymer/Dope, Dope dyeing

Spinning Systems – Linking yarn types and spinning processes; Wet spinning, Melt spinning, dry spinning – processes and parameters; Multistage (POY) process

Post Spinning Processes – Different types of texturistion, stress relaxation,

Unit 6: Mathematics and Computation in Textiles:

Statistical description of test data – measures of central tendency and dispersion; Objective tests of significance like "t", "F", Chi square and the Analysis of Variance; Tests for analysis of subjective data; Correlation and Regression; Multivariate statistical tools.

Fiber Calculations – Use of Linear programming (on k, u, s, m & f) to optimize cotton mixing, draft calculations and settings

Yarn Calculations – interpretation of Uster spectrograms; and Instron and Tensorapid charts; Fabric Calculations – Sizeing calculations; Computation of fabric parameters from test results; computation of production figures.

Wet Processing Computation – Numerical color systems; Calculation of color recipes (CIE method) and the adjustment of color recipes from trial dyeing; Computation of material/Liquor ratios for multiple solutions.

Unit 7: Mechanics of Textile Machinery:

Machinery calculations – Power storage and utilization calculations for textile machines; Gear and Draft calculations for textile spinning machines; Statics and kinetics of various sub systems of spinning preparatory and weaving machinery; Balancing of rotating machine components; Cam design.

Unit 8: Textile Physics:

Bulk Properties of Textile materials – Length, breath and width / diameter, density, moisture regain, thermal properties, electro-magnetic properties, tensile properties, bending and buckling modulus, frictional behavior, torsion properties, abrasion resistance and optical properties

Fine Structure – The theory of the structure of fibers at the crystal lattice level(fringed micelle theory), amorphous and crystalline regions, degree of order, and orientation etc. etc.; Explanation of bulk properties in terms of the fine structure properties and chemical properties.

Unit 9: Textile Chemistry:

Chemistry of the structure of polymers – The chemistry of polymer forming monomers; The polymerization process; Chemical properties of polymers and what is required to have fiber forming capabilities Chemistry of the structure of dyes – theory of chromophore groups, dye structure and affinity to fibrous materials Chemistry of the dyeing process – Different types of dyeing processes; Physical and chemical affinity, monderants etc etc; Molecular reasons for different types of affinity between polymer and dye; Kinetics of dyeing, effects of temperature, Material/Liquor ratio and time; retarding and accelerating agents.

Unit 10: Business in the Textile Industry:

Finance – Starting a new Textile Unit, Existing Unit - Raw material Purchase and Inventory, New Machine Procurement, Power Costs Mill design – Design and construction of spinning and weaving mills, Populating a new Mill - Balancing of machinery calculations, Selection and purchase of Machinery

Product Planning – The Textile market, salability of different product, development and implementation of yarn and fabric Production Plans Balancing of Machine Numbers – Machine/Staff allocation to products. Textile costing – Cost estimation of different products, calculation of selling prices, Estimation of marketability of products The Front Office – Management – Human resources, hiring, salaries & benefits, promotion plans; Payroll data and disbursement, Inventory control, Financial Records and analysis, Marketing.

PRINTING TECHNOLOGY

Syllabus

Unit 1:

Design – Basic concept - creativity, Steps in creativity, typography, Graphic Design consideration, Symbols and logos. Layout – purpose & advantages, layout styles, layout components, stages in preparing a layout, marking-up, Dummy. Designing for Newspapers, Booklets, Magazines, Business publications, Banners & Posters, Advertising, Transit, Interactive, Web and in Maps.

Unit 2: Pre Press:

Conventional Pre Press – Word Processing and Typesetting – Procedure, manuscript – Type of inputs, Font – Types, Text output - film / plate, Image setters, Planning layout – Information, type of work, Preparing the layout, Imposition schemes, Book work – Margin calculations, Methods, positive and negative assembly, step and repeat. Digital Pre Press - Image Acquisition – Digital Camera – Principles, mechanisms, types, resolution, memory, Scanner Types – Flatbed and Drum, screening frequency, DOT structure AM and FM screening, Comparison, resolution, storage, file formats – Workflow – Automated workflow – components, File Preparation, Colour Management, Preflighting, Digital Imposition – preRIP, postRIP, OPI, Trapping, Postscript, PDF, CIP4 – JDF, JMF – RIP (Raster Image Processing), resolution – Input, output, Image setters and plate setters – Types, Digital proofing – Need, Proofing technologies – Inkjet, Dye sublimation, Thermal Wax, Electro photography. Inks, Dyes, Toners, Quality and relative merits.

Unit 3: Image Preparation

Conventional Methods: Plate Chemistry and Processing. Positive, Negative plates - Base materials & properties – Aluminium, Stainless steel, Copper, Chromium, Nickel, Poly masters and paper masters, Graining – types, Contact angle and wettability, Anodisation – Process, Plate chemistry – Light source – Types – advantages, disadvantages - Desensitizing process, gum, developing inks, lacquers and asphaltum, Quality Control Aids., Digital – Computer to Plate – Imaging for lithography: Computer to plate (CTP) and Computer to press systems, their architecture, workflow, equipments used, type of plate used – silver halide, thermal fuse, photopolymer plates and their structures and technique of imaging – laser, UV, thermal imaging. Computer to Polyester Plate (CTPP) and technique of imaging, quality control devices. Imaging for gravure Process: electromechanical engraving of gravure cylinders, equipments used, engraving with single and multiple head engravers, digital workflow. Laser cutting of gravure cylinders, type of plastic material used for the laser cutting cylinder, system architecture and workflow, quality Control. Imaging of flexography: Laser engraved design rolls for continuous patters, plate types – Rubber and Polymer and production of design rolls, laser engraving techniques. Cushion Core photopolymer plates, developments in special construction photopolymer plates, equipment used, and quality aspects. Imaging for screen printing: Imaging on cylindrical screens, laser engraving of rotary screens, equipment and process used, imaging technique, materials of cylindrical screens and quality aspects.

Unit 4: Press:

Offset Printing: Principles of Offset, Sheet-fed – Feeding and Control, Printing Unit Configuration – Design Concept and Cylinder Configuration, Printing Blankets, Rollers and Fountain Solution, Printing and Inline Operations, Web-fed Printing Presses: Types, Press Classification and Infeed Units, Printing Unit - Design Configuration and Types, Inking and Dampening Systems, Drying, Chilling, Folding and Sheeting Units and Mail Room Operation. Flexographic Printing: Mounting and Proofing procedure, Press types – stack, CI, inline, narrow web, wide web, Variations of press – coating, lamination, corrugated postprinting, environment & safety aspects, web tension - control, guiding and viewing unit. Gravure and Screen Printing: Doctor blade – types, positioning, impression rollers – types and important, inking, dryer systems - types, in-feed, out-feed and converting operations. Screen Printing – Screen fabrics, frames, and squeegees – types, screen printing machine – types, maintenance. Digital Presses: computer to press, types, advantages and applications, Green Printing.

Unit 5: Post Press and Converting Operations:

Production Flow in Print Finishing, Folding – Types of Fold for Sheet and Web, Methods of Feeding and Delivery, Cutting Machine – Parts, Types of Cutting Machine, Knife, Mechanism and maintenance of Guillotines, Gathering and Securing: Principles of Gathering and Types of Machines, Securing, Stitching and Sewing – Types, Miscellaneous Operations – Edge Treatment, Case making, Embossing Foil Stamping, Dye Cutting, Indexing, Lamination Types, Shrink Wrapping, Automation in Finishing Operations.

Unit 6: Printing Materials:

Paper and Board – Raw materials and pulping, kinds of cellulose Fibres, Pulping Methods, Bleaching Techniques, Stock Preparation, Paper and Board Manufacturing, Paper making machines, different sections and its functions, paper coatings – methods of coatings, Calendaring – Types, Board Manufacturing, Paper and Paper Board classifications, paper

requirement for different printing processes, Paper and Board Properties and Paper related problems in printing. Printing Inks – Raw Materials – Colorants, oils, Binder – Types, their importance in printing ink formulations, Varnishes – Types, Additives – Properties and Applications, Printing Inks for different process, Ink Manufacturing, Ink Testing and Measurements. Specialty Inks – Water Based Inks, Radiation Curable inks, Inkjet Inks, Security Inks and Ink drying mechanism, ink related problems and remedies.

Unit 7: Package Materials and Technology:

Packaging Materials – Wood, Textile, and Paper & board – Types and Properties and applications, Specialty Papers, corrugated boards - Types, Specification and applications. Plastics – Plastic in packaging, types and advantages, Flexible and Rigid Packaging, materials used – properties and applications. Recycling, Biobased Packaging Materials, Glass and Metals – Types, Properties and Uses, Metals – Tin, Aluminum and Steel, Properties and Uses, Foils and metallization Methods. Nano composites and its applications in packaging, Label – Types, Additives used, Closures and Sealing, Cushioning materials, Lacquers and Special Additives, Materials testing – Mechanical, Optical and Chemical Test for packaging materials. Packaging Technology – Need, functions, types and selection of package, shelf life, package design – types, CAD applications in packaging, folding carton manufacturing, machineries, applications, collapsible tubes – manufacturing and applications, specialty packaging, package performance testing

Unit 8: Advertising, Scheduling and Cost Estimation:

Advertising – Introduction, Advertising planning, Media, Production and Co-ordination.

Scheduling – Concept of scheduling and its important, Sequencing, Inventory Management, Materials and Capacity requirement planning and network models in connection with printing industry. Cost Estimation – Basic concept of costing, Pricing, Estimation and Investment analysis – Cost estimation for printing materials and for different printing process in respect to various print jobs.

Unit 9: Publishing:

Newspaper and periodical publishing – operations of newspaper and magazine companies, organizational structure, management functions, editorial process, production workflows and legal issues. Book Publishing – Areas of publishing, editorial process, production management, distribution methods and legal aspects involved in book publishing. e-publishing - Internet, eBook, eJournals, eNewspaper, internet advertising, digital libraries, eReaders – e-Ink, e-paper, Crossmedia publishing, Advantages, Issues. Web publishing – Layout & Design, Accessibility, usability, standards, publishing on handheld devices – Layout & Design, reference database – PUBMED etc. Index – author, volume, keyword. Workflow, Softwares & Tools and Emerging Trends.

Unit 10: Quality Control in Printing:

Definition of Quality, its purpose. Setting up a quality control programme and establishing necessary procedures, economic consideration. Management responsibility. Quality Systems and ISO 9000, Statistical Quality Control, Materials, process control, ISO standards for process – ISO 12647-1,2 &3, Implementation and Guidelines, Quality Control Devices, Quality control aids – offset, flexo and gravure, print problems and remedies.

POLYMER TECHNOLOGY

Syllabus

Unit 1: Fundamentals of polymers

Classification of polymers – natural / synthetic; organic / inorganic; addition / condensation; thermosets / thermoplastics. Types of polymerization - chain , condensation and copolymerisations. Kinetics and mechanism of chain polymerization – free radical, anionic, cationic and co ordination. Living polymers. General characteristics and mechanism of condensation polymerization. Kinetics and mechanism of copolymerization; Relative reactivity ; Types of copolymers. Bulk, solution, suspension and emulsion polymerization techniques – Tromsdorff effect Polymer microstructure-chemical and geometrical structure - Linear, Branched, and Crosslinked Polymers ; dendrimers;Carother's equation - ladder, star and honey- comb polymers – interpenetrating networks .Tacticity . crystalline and amorphous polymers:Factors influencing crystallinity – folded chain structure, spherulites. Thermal transitions: glass transition temperature (T_g) - importance of T_g - factors affecting T_g - determination of T_g ; Crystallisation; Melting. Polymer solution behavior. Liquid crystalline polymers.

Unit 2: Plastic materials

Manufacture, properties and applications of commercially important, Commodity, engineering and high performance thermoplastics and thermosetting polymers - Polyethylene, Polypropylene, Polyvinyl chloride, Polystyrene, polyamides, polyacetal, polyesters, Acrylics, Cellulosics, polycarbonate, PTFE, polyurethane, polyphenylene oxide, polyphenylene sulfide, PEEK, phenol formaldehyde, Urea/melamine formaldehyde, unsaturated polyester, epoxy resins, silicones.

Unit 3: Polymer Blends and Alloys

Definition; Miscibility of polymers – Methods of determining miscibility. Immiscible blends: phase separation - compatibilisers - compatibilisation – melt rheology - morphology. IPNs and thermoplastic elastomers. General behavior (Reaction blending, processing, interfacial properties, compatibilisation, morphology, flow behavior and performance) of specific thermoplastic/ thermoplastic, thermoset/thermoset, thermoset/ thermoplastic blends.

Unit 4: Plastics Processing

Classification of plastics processing operations – primary; secondary. Compounding of plastics: Additives – Fillers, plasticizers, pigments, stabilizers, flame retardants, antioxidants, Lubricants and processing aids; Equipments – Twin screw extruder, Banbury and other mixing equipments. Differences in the processing of thermoplastics and thermosets. Extrusion, Injection molding, Blow molding, Thermoforming, Rotational molding, Film blowing, fiber spinning, Calendering, Casting, Foaming, Compression molding, Transfer molding, Reaction injection molding, Finishing, assemblyand surface treatments.

Unit 5: Plastics product and mold design

Product design: Design criteria based upon based on end use and geometry: Stress analysis, Materials selection, Forming process selection. General Design Guidelines : Wall thickness, Ribs and profiled structures, Gussets or support ribs, Bosses, Inserts, sink marks, feeding system, gate location, flow pattern, Holes , Radii & Corners , Tolerances, Coring, Undercuts, Draft angle shrinkage and post molding shrinkage.

Mold design: Single, multicavity, semi automatic and automatic molds. Materials and Process selection. Design details for injection, compression, transfer and blow molds. Design of different types of dies for extrusion process. Applications of CAD in design/operating systems : Wire frame, surface and solid modeling – Unigraphics, Ideas, Pro-E and mold flow software.

Unit 6: Plastics Testing and Characterisation

Identification of Plastics – Analytical tests (Chemical methods). Plastics testing: Mechanical (short term, long term; of surfaces) Thermal, Electrical, Optical and Flow properties -Importance, Standard methods - ASTM, BSI, ISO, DIN etc, preparation and conditioning of Test specimens, experimental set up, procedure, significance and factors affecting all the properties; correlation with actual performance of the product. Test methods for quality control of end products. Determination of molecular weight: End group analysis, viscometry, GPC. Thermal Properties : DSC, DTA and TGA. Determination of crystallinity by density measurements.

Unit 7: Recycling of plastics and waste management

Plastics and environment : Global policy –Regulations. Sorting and Separation techniques of mixed plastics: Wet and Dry separation – Centrifugal sorting ; Electrostatic sorting ; X – ray based sorting. Size reduction – Densification process. Recycling of PET, HDPE, LLDPE films, PVC etc. – Pyrolysis and incineration of plastic waste for energy recovery. Polymer degradation: Types – thermal, photo and oxidative degradations. Bio degradable polymers: prospects and applications.

Unit 8: Polymer foams and composites

Types of **Foams** : Polyurethane, EPS foams – Formulation, properties and Applications. Plastics packaging – Advantages and disadvantages – Printing on plastics packaging.

Polymer Composites: Definition, characteristics including anisotropic behaviour, advantages and disadvantages over traditional materials. Fiber reinforced plastics: short and continuous fiber reinforced- critical fiber length; specific strength and modulus and other properties ; Fibers – glass, aramid, carbon, boron, ceramic and natural (coir, jute, banana, pineapple etc); Interfacial bonding and surface treatment of fibers. Thermosetting and thermoplastic resins for composites. Fabrication techniques: Hand/spray lay up, RTM, filament winding, prepreg technology, compression molding and pultrusion. Applications.

Unit 9: Allied Materials

Rubber: Structure – property relationship; General purpose rubbers – NR, BR, SBR, IR; Specialty rubbers – IIR, EPR, NBR, CR, ACM, EMA, EVA; High performance rubbers – silicones, fluorine containing rubbers, PUs ; Thermoplastic rubbers – Various types.

Fibers: Essential characteristics and molecular architecture of fiber forming polymers. Natural and man made fibers – Spinning – General principles of fininshing and dying of fibers.

Ahesives: Mechanism and theories of adhesion. Natural, synthetic, reactive and non reactive adhesives : preparation, properties and applications. Surface preparation, joint design and joint types.

Paints and coatings: Oil Paints - Constituents and drying of paints; mechanism of film forming; Powder coating; Water based coatings.

Unit 10: Polymer Rheology

Newtonian and Non-Newtonian fluids – pseudoplastic, Bingham, dilatants and thixotropic behaviours - Factors influencing flow behavior – Mechanical models – Relationships of various approaches used in describing the viscous and elastic properties – Measurement of rheological properties and their application in polymer processing.

SUGAR TECHNOLOGY

Syllabus

Unit 1: Heat and Mass Transfer:

Flow of heat – different modes of heat transfer - heat transfer through compound resistances - heat transfer through fluids - Law of thermal radiation - Newton's law of Cooling – Heat transfer equipment – different types of heat exchangers – different types of evaporators – Multiple effect evaporators – Calculations.

Mass Transfer : Theory of Mass Transfer – Derivation of Mass Transfer equations - Extraction – various equipment for extraction – Theory of separations – Solid /Solid separation – Solid/ liquid separation – Liquid /liquid separation – Settling –Filtration – Centrifuging - Theory – various equipments –Theory of Settling –Theory of Filtration –Theory of Centrifuging –various equipment – Membrane Separations.

Mixing and agitation – Various mixing equipment – Theory – Power consumption formula.

Gas absorption & drying – Theory of gas absorption – Humidity – Relative humidity – Theory of drying – various drying equipments.

Crystallization - Solution –Solubility – Super saturation - Mier's Theory of Crystallization – Rate of crystallization – Various equipment for crystallization – various methods of crystallization - Cake formation.

Unit 2: Milling:

Cane Handling – Different type of cane unloader - Merits and Demerits.

Cane Carrier – Construction - Slope – Drive – Length - Speed – Width – Power consumption – Split Cane Carrier – Atomisation.

Cane – Preparation - Aim - Different types of preparatory devices and drive – Their merits and demerits – Power consumption.

Milling – Mill capacity – Mill – setting – Milling Efficiency Different types of Mill drive – Trash plate setting – Bearing – Pinion – Scrapers - Roller grooving – Different types of mills housing.

Hydraulic pressure – Different types of hydraulic loading – specific loading – Different types of pressure feeding – Mills speed – Imbibitions – Different types – Factors affecting Milling capacity and Efficiency - Inter Carriers – Different types – Power consumption – Low cost milling – Diffuser.

Unit 3: Process Control and Instrumentation:

Introduction to instrumentation – Terminology – Transducers Indicator – Recorder – Control Pressure and Vacuum Gauges – Different types of Manometers – Elastic device Construction, theory and working – Calibration – Dead weight tester – Diaphragm type Bellows – Draft gauge – Thermometers – Liquid, Gas and Vapour filled thermometers – Temperature correction – Bimetallic thermometers – Principle, Construction & Working thermocouples.

Flow Measurement: Orifice meter – Venturimeter – Rotameter – Magnetic flowmeter – Construction, Working and design.

Level measurement – Differential pressure – Ultrasonic, Optical methods.

Analytical Instruments: Conductivity meter – pH meter – Moisture meter – Gas Analyser.

Controls – on/off controller – Proportional Controller PID controller – Programmable controller – Direct Digital controllers – Supervisory control – Distributed Control – Control valves – Temperature and Pressure control systems for sugar industry – Application – Instrumentation – Electronics used in Sugar Industry, Boilers and pans.

Fully Automation of Sugar Industry.

Unit 4: Sugar Process Calculation and Solid Balance:

Terminology, Pol % Cane, Mill Extraction, Reduced Mill Extraction, Milling Loss, Whole Reduced Extraction.

Imbibition % Fibre, Overall Extraction, Reduced Overall Extraction, Primary Extraction, Secondary Extraction based on simple and compound imbibition.

Brix Curve, Individual Mill Extraction, Individual Mill Efficiency. Boiling House Recovery, Boiling House Loss, Virtual Purity of final Molasses, Reduced Boiling House Recovery.

ERQV, SG, ESG, Recovery in terms of ESG, Basic Boiling House Recovery, Boiling House Performance. Pol Balance, Brix Balance, Non Sugar Balance, Water Balance.

Brix Free Cane Water, Java Ratio, Winters formula, Stock Taking. Solids Balance for a Footing, A- Massecuite, C- Grain, C- Massecuite, B-Grain, B- Massecuite, C- Massecuite Fore Curing, C- Fore Curing, B- Massecuite Double Curing, A- Massecuite Curing. R.T.7(7), R.T.8(C).

Unit 5: Sugar Technology Clarification and Evaoration:

Composition of cane and cane juice, Aim of clarification, clarification efficiency. Carbonation process, Double sulphitation process, Phosphitation process.

Various juice heaters, Various clarifiers, Vacuum Filters. Milk of lime preparation, Sulphur burner and preparation of SO_2 Gas.

Juice Sulphitation, Syrup Sulphitation, Use of different chemicals. Aim of evaporation, Different types of evaporators, Different types of vapour bleeding System, Steam economy, DEVC cum Quad System,

Quintuple system. Scale formation, De scaling, Cleaning procedure. Different types of condensers, Condensates, Ammonia gas, Entrainment Save all.

Syrup / Melt Clarification, Filtrate Clarification.

Unit 6: Sugar Machinery Design:

Site Selection, machinery lay out, General Design.Method of fabrication, Design procedures, Material of construction and properties, Design and corrosion control, Vessel Design, Design of supports.Trash plate profile, Juice Heaters, Juice Sulphitors, and Clarifiers. Evaporators, Syrup Sulphitors. Pans (Batch/Continuous)-Molasses conditioners, Melters, Syrup/ Melt clarifiers, Filtrate clarifier- Crystallisers (Seed, Vacuum, Air/Water cooled, and Vertical).

Condenser and common Heaters, Molasses tanks, Spray pond, Work shops Machinery.

Unit 7: Capacity Calculations:

Milling: Unloader, Cane Carrier, Preparatory Devices, Mills Size, Inter/Rake Carrier, RBC, Power Requirement, Diffuser.

Boilers: Boiler, Gate Area, Combustion Chamber, ID FD, Chimney, Possibility For Maximum Export Of Power To Suit Crushing Rate.

Clarification: Juice Flow Meter, Juice Sulphitation Vessel, Sulphur Burner, Lime Slacker And Lime Tanks, Flask Tank, Clarifier, Vacuum Filter, Juice Heaters, Condensate Pumps, Ammonia Lines, Juice Pumps, Air Compressor.

Evaporators: Heating Surface, Vapour Line Dia, Condensers, Condensate Pumps, Ammonia Lines, Steam Requirement, Steam Economy, Syrup Sulphitor.

Pans: No. Of Pans, Heating Surface, Vapour Line Dia, Molasses Conditioners, Supply Tanks, Continuous Pans. Crystallisers: Vacuum Crystallisers, Water/Air Cooled Crystallisers, Vertical Crystallizer, Hot And Cold Water Tanks.

Cooling and condensing: Injection Pumps And Water Requirement, Spray Pond, Capacity, Pumps, Common Header, Condensers.

Centrifugals: No. Of Centrifugals, Gravity Factor, Super Heaters, Hopper, Grader, Hot And Cold Air Blowers, Sugar Elevator Sugar Bin.

General: Water Requirement, Sugar Godown, Molasses Tanks ETP.

Unit 8: Mechanical and electrical machineries:

Applied Thermodynamics – Law of perfect gases – PV diagrams – Carnot cycle - Reversible, irreversible cycles – Otto cycle – Diesel cycle.

Air Compressors – Different types of Compressors – Cycles – Power Consumption efficiency.

Steam turbines – Different types of turbines including Double Extraction, Condensing turbines – Stopping & Starting of Turbines, Vibration – Fundamental Analysis – Influence – Calculation of blade angle – steam consumption.

Pumps – different types – Uses – Maintenance. Electrical Machinery & Power: Resistors – DC circuits – Inductors and Capacitors – AC Circuits – Power and Power Factor – DC Generators – DC Motors – Starters – AC Motors – Starters – Transformers – Cogeneration – Energy Audit.

Unit 9: Pan Boiling, Curing and by Products:

Aim of crystallization, different types of massecuite boiling supply tanks, molasses conditioner, vacuum crystallizers. S/V ratio, boiling point elevation, hydrostatic head, massecuite circulation. Super satuaration co-efficient, different super saturation zones.

Slurry preparation, true seeding. Raw sugar boiling, refined sugar boiling. Scaling, cleaning procedure.

Treatment of massecuite by air and water cooling, vertical crystallizers for B and C – massecuite. Batch centrifugals, continuous centrifugals, curing of different massacuite, liners for different machines, molasses separators, different types of lubrication, super heated wash water, pug mill, run off tanks, magma minglers, melters, use of syrup for affinition and melters.

Gross hopper, hot air blower, cold air blower, sugar elevator, sugar grader, sugar bin, sugar bagging, sugar storage in the godown. Sugar beet, sweet sorghum, carbon credit.

Compostion of bagasse and its uses, composition of final molasses uses, composition of filter cake and its uses, composition of tops, trash and its uses, composition of boiler ash and its uses. Ethanol from sugar house products.

Unit 10: Food Process Engineering and Technology:

Carbohydrates – Proteins, Lipids, Vitamins, Additives, Preservatives, Solvents, Flavours, Agents, Food Engineering operations, Food sorting, Cleaning , Grading – harvesting – winnowing – drying – Storage – Prime processing.

Food engineering process operations -Materials and Energy Balance- Fluid flow applications, Heat transfer applications – Drying Evaporation, Equilibrium stage process, Soxhlet extractions, Applications –Mechanical separations Mixing, Applications, Diary, Meat Industry, Oil and Flat Industry Cereal processing.

Preservation operations-Preservation methods & Strategies, Thermal Methods, Nabla Factor Sterilisation Types, Pasteurisation Dehyro freezing Irradiation, Dosimetry Transport of Food & Preservation strategies Cheap and applicable everywhere.

Plant hygiene- Plant Hygiene Design Sterilisation, Process water quantity upkeep waste disposal, Material handling, packaging of solid and Liquid foods, Food storage, Special case studies.

Development in food processing - Development in Food Processing Pruteen Food for future, Food constituents and processing Food emulsions food Rheology Advances in thermal Operation Extrusion, cooking Spray dryer design, Energy expenditure & saving Food for developing countries , Food Detoxification , Production of sweeteners, starch, Microbial polysaccharides ,Amino acid, Rice bran Tocopherols. Quality control in food industry, Dose response relationship, Health problems, Chemical and Micro biological aspects, Food analysis, Instruments and Enzymatic analysis, Food safety.

Unit 11: Modern Separation Process:

General- Review of conventional process, Recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics substances, Process concept , Theory and equipment used in cross flow filtration, cross flow electro filtration, dual functional filter, Surface based solid - liquid separation involving a second liquid, Sirofloc filter.

Membrane separation - Type and choice of membranes ,Plate and Frame ,Tubular ,Spiral wound and Hollow fibre membrane reactor and their relative merits, Commercial ,pilot plant and laboratory membrane permeators involving dialysis ,reverse osmosis, Nano filtration ,ultra filtration, Micro filtration and Donnan dialysis, Economics of membrane operations, Ceramic membranes.

Separation by adsorption techniques - Mechanism, Types and choice of adsorbent, Normal adsorption techniques, Affinity chromatography and immune chromatography. Types of equipment and commercial processes, Recent advances and process economics.

Ionic separation - Controlling factors, Applications, Types of equipment employed for electrophoresis, Dielectrophoresis, ion exchange chromatography and electrodialysis, Commercial processes.

Other techniques- Separations involving lyophilisation, Perevaporation and permeation techniques for solids, liquids and gases. Industrial viability and examples, Zone melting, Adductive crystallization, other separation process, Supercritical fluid extraction, Oil spill management, Industrial effluent treatment by modern techniques.

Unit 12: Safety Engineering:

General -Safety- total definition – hazard identification, general hazards of plant operation, toxic hazards, fire & explosions – hazards transport of chemicals with safety unforeseen deviations emergency management, planning for safety, selecting basis of safety preventive and protective measures, safety bases on emergency, relief systems, safety based on containment, operational safety procedural instructions Sla-routine checks, process and product charges, safety checks, checklist for safety, leaks and detection.

Hazards and effects- Hazards of plant operation, toxic hazards, fire and explosion hazards, reaction hazards, literature calculations & explosions screening, normal reaction, gas evolution, characterizing runaways, control and mitigation of gas emanations, absorption with chemical reaction, health and environmental effects.

Special problem of developing countries, safety gadgets, dispensions, degree of hazard, disposals, hierarchy of options, I.C.A. application, nil hazards & alternate methods, threshold limits, laws of safety, accident reporting.

Accident reporting investigation and documentation- Reporting and accident – selling up closed loop reporting system – Automated system – Forming and investigation board - Conducting an investigation – investigation report – Documenting the accident – Retention of records – Public release of information.

Waste management and economics- Storage, central handling safety, unintentional spills, run offs emits, containment economics, waste disposal and environment projection, incineration, alternatives.

Risk analysis- Risk analysis, evaluation, mitigation, hazop, hazan, definition, probability, quantification – risk, engineering, clean technology, initiatives, standards, emergency handling, accident investigation, legislation, nil risk quantification methods, case histories of accidents, examples of hazards assessment, examples of use of hazan, explosion hazards in batch units, technical process, documentation for hazardous chemicals, format and methods.

Unit 13: Sugar Agriculture:

Sugar producing plants. History, Origin and Distribution of Sugarcane – Major Sugarcane producing countries in the world. Area under sugarcane in different states of India. Cultivation of sugarcane: Brief lectures on soils types, preparation of land, periods of sowing, cane seed, methods of planting, optimum conditions for germinations, tillering growth and maturity of the crop.

Nutrition of sugarcane – Nitrogen, Phosphorous and Potash – Effect of each element on tonnage and sugar content: A lecture on the role of the micronutrients in sugarcane. Plant protection measurement of sugarcane – Major diseases and pests – symptoms, period of occurrence, control measures and effect on yield and sugar content – Harvesting and transport management – Method for testing - maturity of sugarcane – Advantages of harvesting sugarcane on the basis of Pre-harvest maturity test.

Sugarcane varieties. Deterioration of sugarcane – factors affecting deterioration and control measures. Effect of deterioration of cane on weight and sugar content.

Burnf cane – Effect on weight and sugar content. Sugar Beet – A brief lecture on requirement of the crop and potentialities for growing in India. Cultivation of sugar beet and Sweet-Sorghum, methods and period of sowing, fertilization and maturity. Comparison of sugarcane and sugarcane beet for producing sugar in India.

Unit 14: Statistical Analysis:

Elementary Probability Theory- Axioms Of Probability – Conditional Probability – Total Probability – Bayes Theorem – Random Variables – Discrete And Continuous.

Empirical Statistics-Measures Of Central Tendency, Dispersion, Skewness And Kurtosis – Principle Of Least Squares – Correlation And Regression – Rank Correlation.

Sampling Distributions And Estimation- Sampling Distribution – Point And Interval Estimates For Population Proportions, Mean And Variance – Maximum Likelihood Estimate Method - Method Of Moments, Interpolation And Extrapolation.

Testing Of Hypothesis- Sampling Distributions – Tests Based On Normal, T, Chi-Square And F Distribution – Analysis Of Variance – One Way And Two - Way Classifications.

Design Of Experiments- Completely Randomized Design – Randomized Block Design – Latin Square Design-2 Power 2 Factorial Design.

Unit 15: Energy Engineering:

General- Energy Resources – Conventional – Non Conventional, Energy Reserves And Depletion, Non-Renewable Energy Sources.

Power Generation- Power Generation By Steam, Hydroelectric, Diesel Oil, Nuclear Fission And Natural Gas, Co-Generation Of Power. Selection Of Power Generation Process, Economical And Technical Efficiency Of Power Generation, Socio-Economic Factor Affecting Consumption Of Pwer By Various Methods, Design And Safety Of Equipments.

Alternative Energy- Renewable Sources Of Energy, Thermal And Power Generation Using Water, Wind, Sea Wave, Solar Energy, Geothermal And Biomass Utilization.

Energy Consumption And Audit- Energy Consumption Demand Pattern, Energy Planning – Short Term And Long Term, Energy Recovery, Various Types Of Energy Audit – Advantages. Energy Conservation- Sugar Industries; Conservation In Unit Operation Such As Separation; Cooling Tower Drying; Conservation Applied To Sugar Refineries; Conservation Using Optimization Techniques.

MODERN OFFICE PRACTICE

Syllabus

Unit – 1: Accounts & Finance:

Basic Accounting concepts - Capital & Revenue - Financial statements - Preparation of final Accounts - Schedule VI Part I & Part II. Partnership Accounts - Admission, Retirement, Death, Dissolution & cash distribution. Single Entry - Statement of Affairs method & conversion method.

Company Accounts - Issue & forfeiture if shares - Issue & Redemption of Preference shares & Debentures - Purchase of Business - Profits prior to Incorporation - Managerial Remuneration - Dividend declared out of the past and current profits - Issue of Bonus shares - Preparation of company balance sheet - Amalgamation, Absorption, Internal reconstruction - External reconstruction – Liquidation - Accounts for Banking & Insurance companies - Valuation of shares & goodwill - Inflation Accounting - CPP & CCA Method -Human resource Accounting - International Accounting Standards.

Cost Accounting - Meaning & definitions - Nature & Significance - Characteristics of ideal costing system - Elements of Costing - Cost concepts - Fixed & Variable costs -Preparation of Cost sheet – Costing methods: Job costing, Unit costing, Process costing, Service costing, contract costing & marginal costing – Materials – Labour – Overheads - Reconciliation of cost & financial accounts.

Management Accounting – Meaning – Nature – Objectives - Scope & Importance –Limitations - Analysis and interpretation of financial statements - Tools of management accounting: Ratio Analysis, Fund flow statements, Cash flow statements, Budgetary control, Variance analysis and Marginal costing (Applications of Marginal Costing).

Unit – 2: Financial Management:

Financial Management - Meaning and Definitions - Nature and scope – objectives -Role and functions of financial manager - Risk and Return relationship - Cost of Capital: Meaning and importance - Cost of debt, equity, preference equity and retained earnings - Weighted average cost of capital - Capital budgeting techniques: ROI, Payback period and discounted cash flow.

Financial leverages - operating leverages – EBIT - EPS analysis - Financial, operating and business Risks - Capital structures – Theories - Net Income approach - Net operating income approach - MM approach - Determinants of capital structure - leasing and its types - Advantages and disadvantages of leasing - Evaluation of leasing.

Dividend theories & polices - Walter's model - MM model - Determinants of dividend policies - Working capital management – Concept – Importance - Determinants and computation of working capital - Working capital forecasting - Management of Inventories, cash and receivables.

Unit – 3: Human Resource Management:

Human Resource Management – Meaning – Importance – Scope – Objectives – functions – Organisation structure - Human resource planning - Job Analysis - Role Analysis - Selection and recruitment – Testing – Interview – Placement – Promotion - Job evaluation and Merit rating - Job morale and Satisfaction - Performance appraisal - Various Training programmes - Theories X and Y - Motivation theories.

Human behaviour in organisation - Perception Learning - Definition of learning - Learning theories – Concept – Personality - Determinants of personality - Theories of personality – Group dynamics - Decision making process – Nature

- psychological barriers of decision making - Creativity in decision making - Traditional, Quantitative, Creative and Participative decision making techniques.

Discipline – Meaning – Causes of indiscipline – Acts of Indiscipline – Procedure for disciplinary action – Grievance – Meaning – Characteristics of Grievance – Causes of Grievance – Grievance knowing methods – Redressal procedure.

Organisation conflict - Individual conflict - Organisational conflict - Management of conflicts – leadership - Types of leaders - Theories of leadership - Qualities of a good leader - Workers participation in management.

Unit – 4: Economics:

Economics - Meaning and Definitions - Nature and scope – Concepts - Theories of Economics: Adam Smith, Robinson and Samuelson's theories - Criticism on economic theories.

Demand Analysis - Determinants of demand - Elasticity of demands - Types of elasticity - Factors influencing elasticity of demand - Demand forecasting – Goods - Types of Goods - Consumer Surplus.

Cost concepts - Cost and Output relation - Cost control and Cost reduction - Behaviour of cost in short and long runs - Break even analysis - Economies of large scale production.

Market Structure - Perfect, Imperfect, monopoly, Monopolistic competition and Oligopoly - Price determination - Pricing policies - Business cycles - National Income - Monetary policy and fiscal policy - Public finance - Public debt.

Unit – 5: Marketing:

Marketing - Meaning and Definitions - Nature and scope – Objectives – Functions -Marketing concepts - Market forecasting - Market Segmentation - Market research -meaning, scope and objectives - Future of marketing research - Market information system - Consumer rights and protection - Consumer responsibility.

Product Mix - Product planning - Product development - Pricing Mix - Role of Pricing -Need and importance of pricing - Price determination process - Pricing policies and methods - Promotional Mix - Sales promotion - Various methods of sales promotions –Advertising - Meaning and definition - Functions and objectives of advertising - Channels of advertising - Personal selling process.

Distribution process – Meaning – Importance – Objectives - Establishment of sales policies - Sales organisation structure - Sales force management - Selection, training and control of sales force.

Service Marketing - Meaning and definition – significance - classification of service markets - Organised markets – Features - Functions and objectives - Cooperative marketing - Objectives and need – Functions – Features - Operational methods -Problems and remedial measures.

Unit – 6: Income Tax and Tax Planning:

Income tax – Meaning - Sources of Indian Tax laws - Principles of good tax system - Income Tax Act 1961 - Basic concepts - Previous Year - Current Year – Assessment –Types - Assessee and its types – Person and different types of persons - Residential Status for various persons - Scope of Total Income - Incomes exempted from total income - Agricultural Income - Tax free and relief incomes.

Computation of taxable income under various heads: Salaries, House Property, Business or Profession, Capital Gains and Other Sources.

Aggregation of Income - Set off and carry forward of losses – Deductions - Computation of total income - Computation of total income for Individuals and firms.

Tax Planning - Advance Income Tax - Tax deducted at source - Self Assessment Tax -Returns to be submitted by various assesses.

Unit – 7: International Trade:

International trade - Meaning, Nature and Scope - Role of foreign trade in India - Need for foreign capital - Forms of foreign capital – limitations - Government policies towards foreign capital - Promotion of foreign investment - NRI Investment - Problems in NRI Investment - Balance of Trade and Balance of Payment. Multi National Corporations - MNC Culture and its Implications in social and economic issues - Government policies towards MNCs - Transnational Corporations.

Regional Economic Integration: SAARC – ASEAN – EC - NAFTA

Euro Currency Market – GATT – WTO - World Bank – IMF – IDA.

Foreign Exchange - Exchange rate - Mechanism for exchange rate - Risk Management-Transfer of international payments - Convertibility of rupee - Foreign Investment Institutions & Instruments: GDRs, ADRs, FIIs-Their role in Indian Capital Market.

Unit – 8: Research Methodology and Quantitative Techniques:

Research Methodology - Definition, meaning and nature - Scope and objectives - Types of research: Experimental Research, Survey Research, Case study methods and Ex post facto Research.

Research design - Research Problem - Process of Research - Sources of data collection - methods of Primary data collection - Sampling and Sampling design - Pilot study and Pre testing - Analysis and interpretation of data - Report writing - Steps in report writing -presentation of a report.

Quantitative techniques – Meaning – Role - Advantages and limitations - Correlation Analysis – Simple - Partial and multiple regression analysis - Time series.

Probability - Elements – Theorems - Theoretical distributions – Binomial – Poison - Normal Distribution.

Hypothesis – Definition – Types - Type I Error - Type II Error - 't' test – 'F' test - Chi square test.

Unit – 9: Banking and Financial Institutions:

Bank and Banking - Meaning and definitions – Origin - Types and classification of banks - Commercial banks and its functions – Modern functions of banks – ATM, Credit card, Debit card - Reserve bank of India - Role of RBI - Functions of RBI -credit control measures exercised by RBI - Quantitative and Qualitative measures.

Rural banking system in India - NABARD and its functions - Non Banking Financial Institutions - Development Banks: IDBI, IFCI, SFCs, UTI and SIDBI

Stock exchanges - Working process of stock exchanges – SEBI - Functions & Importance of SEBI as a regulatory authority - credit Rating Agencies

Venture capital funds - Mutual funds – Lease Financing - Factoring - Risk and returns from securities and portfolios.

Unit – 10: Computers in Business:

Computer systems – Importance of computers in Business – Data and information – Data processing, data storage and retrieval capabilities – Computer applications in business – Computer related jobs in business.

Types of computers – Micro, Mini, Mainframe and Super Computers – Analog, digital and hybrid computers – Business and scientific computer systems – First, Second, Third and fourth generation computers – Laptop and Note book computers.

Data processing systems – Batch, online, and real time system – Time Sharing – Multi Programming and Multi processing systems – Networking – Local area and wide area networks.

Components of computer system – input, output and storage devices – software – System software and application software - Programming languages – Machine languages – Assembly languages – High level languages – Flow Chart – System flow chart and program flow charts – Steps in developing a computer program.

Working with MS word – MS Power point – Ms Excel – MS Access – Mechanised accounting with TALLY.

E-Commerce – Internet – Intranet – Extranet – Emails - Its uses and importance – World Wide Web sites.

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